OPERATING NOTE

OPERATING

YOUR

HP MODEL 4943A

TRANSMISSION IMPAIRMENT

MEASURING SET

WITH THE

HP MODEL 9825A

CONTROLLER

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HEWLETT hp PACKARD

TABLE OF CONTENTS

Contents		Page
1.	Introduction	1
4.	Address Selection	1
7.	Programming Data	2
9.	Programmability	2
11.	Programming Procedures	2
14.	Timing Considerations	3
16.	Partial Change of Measurement Parameters	3
18.	Detecting Invalid Measurement Data	3
21.	Sample Master-Slave Program	11
	Remarks, Format Statements, and Set Bus to Remote	12
	Level & Frequency Measurement	14
	Frequency Step Subroutine	16
	Valid Data Detection Subroutine	18
	Error Counter Subroutine	20
	Message Circuit Noise Measurement	24
	Noise-with-Tone Measurement	26
	Signal-to-Noise Measurement	28
	Impulse Noise Measurement	30
	Envelope Delay Measurement	32
	Envelope Delay Data Retrieval Subroutine	34
	Envelope Delay Print Subroutine	36
	Phase Jitter Measurement	38
	Line Description	40
	Sample Printout	46
22.	Optional Verification Program	51
	Setup and Remote Test	52
	Self Check Test	54
	Clear Test	56
	Local Test	58
	Abort Test	60
	Serial Poll Test	62
	Master-Slave Test	64

Figures		Page
1.	HP-IB Address Selection	1

Tables		Page
1.	HP-IB Program Code Set	4
2.	Allowable HP-IB Bus Messages	6
3.	Timing Considerations	7
4.	HP-IB Output Data Format	8
5.	Status Byte	10

1. INTRODUCTION

2. Option 010 adds remote HP-IB capability to the 4943A Transmission Impairment Measuring Set (TIMS). The Model 9825A may be used as the HP-IB controller for the Model 4943A, therefore this operating note is provided. This note assumes one controller and one master unit. The case of multiple master units controlled by one controller is not addressed.

3. This information is given to help the user get started with their 9825A Controller and 4943A TIMS. The main subjects covered include: (1) HP-IB address selection for the 4943A, (2) features that can and cannot be remotely programmed, (3) a sample master-slave program, plus (4) an optional verification program.

4. ADDRESS SELECTION

5. The HP-IB address selector switch is located on the HP-IB PC board assembly A21. The switch is preset at the factory for:

	ASCII	Binary
Talk Address	J	1001010
Listen Address	*	0101010

MSB LSB

The last five bits in the binary code are switch selectable. The first two bits (most significant) are "hard wired" into the HP-IB circuitry.

6. To change the address of the 4943A, follow this procedure:

   a. Turn off the power switch and unplug the power cord.

   b. Release the top cover by turning the four top screws 1/4 turn counterclockwise.

   c. Remove the top cover.

   d. Partially pull out the A21 board (no need to pull it all the way out and disconnect cable).

   e. The address selector switch is seven SPST switches contained in a dual-in-line (DIP) package. See Figure 1. The figure shows the switch with the factory preset values.

   f. The switch settings may now be changed with a pointed instrument (like a pencil or pen).

NOTE

Do not set all address switches to the "1" position. This code is reserved for special use.

7. PROGRAMMING DATA

8. Tables 1 through 5 provide the user with the needed reference data for remotely operating the Model 4943A. Table 1 lists the program code set, giving the codes necessary to implement the programmable measurement functions. Table 2 lists the allowable HP-IB bus messages. Table 3 is a list of the recommended timing delays needed after various actions are implemented. The format of the 4943A output data character string is given in Table 4. This table shows the content of the data word as the 4943A sends it to the controller. The format varies from measurement to measurement. Finally, the 4943A status byte format is given in Table 5.

9. PROGRAMMABILITY

10. Most front panel controls are remotely programmable via HP-IB. The exceptions are:

    a. POWER switch.

    b. SETUP CONTROLS.

    c. TRANSMITTER OUTPUT LEVEL.

    d. IMPULSE NOISE THRESHOLD thumbwheel switches.

    e. LINE MONITOR VOLUME.

    f. ANALOG OUTPUTS.

    g. RCV-TRMT switch.

These controls must be set manually by the operator before proceeding with the use of remote HP-IB operation.

MSB				LSB	ASCII LISTEN ADDRESS	ASCII TALK ADDRESS
0	0	0	0	0	SP	@
0	0	0	0	1	!	A
0	0	0	1	0	"	B
0	0	0	1	1	#	C
0	0	1	0	0	$	D
0	0	1	0	1	%	E
0	0	1	1	0	&	F
0	0	1	1	1	'	G
0	1	0	0	0	(	H
0	1	0	0	1	)	I
0	1	0	1	0	*	J
0	1	0	1	1	+	K
0	1	1	0	0	,	L
0	1	1	0	1	–	M
0	1	1	1	0	.	N
0	1	1	1	1	/	O
1	0	0	0	0	Ø	P
1	0	0	0	1	1	Q
1	0	0	1	0	2	R
1	0	0	1	1	3	S
1	0	1	0	0	4	T
1	0	1	0	1	5	U
1	0	1	1	0	6	V
1	0	1	1	1	7	W
1	1	0	0	0	8	X
1	1	0	0	1	9	Y
1	1	0	1	0	:	Z
1	1	0	1	1	;	[
1	1	1	0	0	<	\
1	1	1	0	1	=	]
1	1	1	1	0	>	^

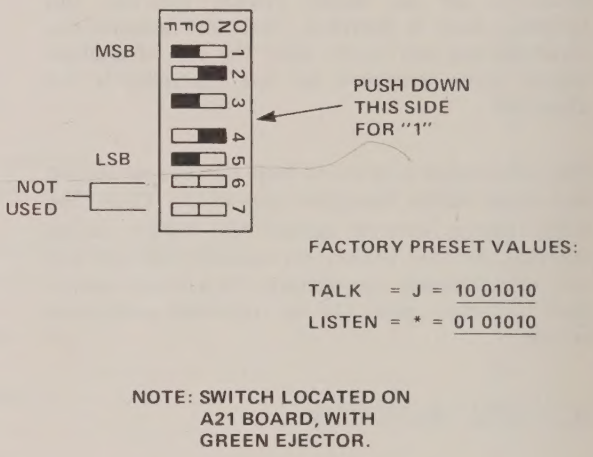

MSB
LSB
NOT USED
PUSH DOWN THIS SIDE FOR "1"
FACTORY PRESET VALUES:
TALK = J = 10 01010
LISTEN = * = 01 01010
NOTE: SWITCH LOCATED ON A21 BOARD, WITH GREEN EJECTOR.

Figure 1. HP-IB Address Selection

11. PROGRAMMING PROCEDURE (An Example)

12. The following procedures assume the use of this equipment:

    a. 9825A Controller

    b. Advanced Programming ROM.

    c. General I/O ROM.

    d. Extended I/O ROM.

    e. 98034A HP-IB Interface Kit (set to select code 7)

    f. 9866B Thermal Printer

    g. 98032A Option 066 printer interface (set to select code 6).

13. Perform the procedures listed below:

    a. Set the non-programmable controls (as listed under PROGRAMMABILITY above) to desired settings.

    b. Connect the 4943A to the telephone circuit under test or perform (c) below.

    c. Loop the 4943A back on itself by connecting jumpers between the front panel TIP and RING jacks.

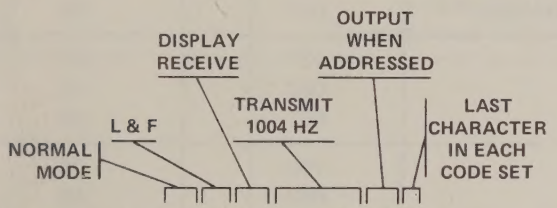
d. Execute the Remote command, address the 4943A to listen, and wait 1/2 second for the 4943A to respond. (NOTE: an internal Clear is issued when the 4943A is set to remote. See Table 2 for 4943A preset conditions with the Clear operation.)

```
example:  10: rem 7
          11: wrt 710
          12: wait 500
```

This statement causes the controller to be the talker on the select code 7 interface, and the 4943A (address 10) to be the listener.

e. Select the measurement mode and other necessary switch settings. Wait 2 seconds for 4943A to respond.

example




```
13:wrt 710,"R0M1D1F1004O0E"
14:wait 2000
```

NOTE

The letter "E" must be used at the end of every code set. Without this "execute" code, the 4943A will not respond.

f. Read the measurement data from the 4943A into the controller.

```
example:  15: fmt 0
          16: red 710,A,B
```

The variable "A" represents data retrieved from the left display, and "B" the right display.

Free field format necessary to read data. Leaving format statement zero unassigned gives it a free field designation.

g. Print the measurement data with appropriate units.

```
example: 17: fmt 1,4x,f10.1,4x,"DB AT"
           ,x,f8.0,x,"HZ"
         18: wrt 6,"LEVEL & FREQ DATA"
         19: wtb 6,10,10
         20: wrt 6.1,A,B
```

h. The measurement is finished. If desired, return the 4943A to local control by executing the Local command. Also, end the program.

```
example:  21: lcl 710
          22: end
```

14. TIMING CONSIDERATIONS

15. The Model 4943A does not respond instantly to measurement commands. Nor does the telephone circuit under test settle immediately. Timing considerations therefore play an important role when writing software. Table 3 lists the timing delays necessary for the 4943A. Timing delays necessary for the circuit under test will need to be determined by observation or experiment.

16. PARTIAL CHANGE OF MEASUREMENT PARAMETERS

17. When a partial change of measurement parameters is needed, only the changed parameter need be attended to. In effect, the 4943A "remembers" all previous instructions except the changed portion of the instruction. For instance, once a measurement is set up (like Level & Frequency), the transmitter frequency may be changed independently. The other parameters, such as setting the measurement or display, are left unchanged.

18. DETECTING INVALID MEASUREMENT DATA

19. After entering any measurement data, the data should be checked for validity before use. Four checks can be made of the data. First, determine if an H-code has been entered. Secondly, determine if an underrange condition exists. Thirdly, determine if an overrange exists. Finally, check if a frequency error has occurred. For instance, if a measurement instruction specifies an 804 Hz transmit frequency by a slave unit, did the master receive it?

20. An H-code appears as the numbers 9900 to 9916 in the left display data. An underrange is indicated by –9999 in the left display data; an overrange by 9999. The sample master-slave program, that follows, makes frequent use of these error detection techniques.

Table 1. HP-IB Program Code Set (1 of 2)

CHARACTER (ASCII CODE)	FUNCTION	OCTAL CODE	DECIMAL CODE
R	Remote (Master-Slave) Identifier	122	82
0	Normal	060	48
1	Master & Master-to-Slave	061	49
2	Master & Slave-to-Master	062	50
3	Slave	063	51
M	Measurement Identifier	115	77
1	Level & Frequency	061	49
2	Message Circuit Noise	062	50
3	Noise-with-Tone	063	51
4	Signal + Noise to Noise Ratio	064	52
5	Impulse Noise	065	53
6	Envelope Delay (Display ED & Frequency)	066	54
7	Phase Jitter or Nonlinear Distortion	067	55
W	Noise Filter Identifier	127	87
0	C-Message Filter	060	48
1	3 KHz Flat Filter	061	49
N	NLD Control Identifier	116	78
0	Normal Test	060	48
1	Check Signal	061	49
D	Display Identifier	104	68
0	Display Transmitter	060	48
1	Display Receiver	061	49
2	Display Delay (use with M6)	062	50
3	Display Level (use with M6)	063	51
F	Frequency Identifier	106	70
(x)xxx	Any Frequency between 204 Hz and 3904 Hz	—	—
Z	Zero Identifier	132	90
0	Level Zero	060	48
1	Delay Zero	061	49
P	Impulse Noise Period Identifier	120	80
0	5 Minutes	060	48
1	15 Minutes	061	49
2	Non-Stop	062	50
I	Impulse Noise Identifier	111	73
0	Stop	060	48
1	Start/Reset	061	49
L	Delay Identifier	114	76
0	Envelope Delay Normal Set	060	48
1	Envelope Delay Repeat Set	061	49
O	Output Identifier	117	79
0	Output measurement data when addressed	060	48
1	Pull Service Request to output data	061	49

Table 1. HP-IB Program Code Set (2 of 2)

CHARACTER (ASCII CODE)	FUNCTION	OCTAL CODE	DECIMAL CODE
S	Sweep Identifier	123	83
0	Set Upper Limit	060	48
1	Set Lower Limit	061	49
2	Stop Sweep	062	50
3	Start Sweep	063	51
4	50 Hz Step	064	52
5	15 Hz Step	065	53
C	Self Check Identifier	103	67
0	Stop	060	48
1	Start	061	49
E	Execute Identifier Note: "E" must be last character in each program code set. Example: cmd 7, "?U*", "M1E"	105	69
Factory Preset Address: Talk = J, Listen = *			

Table 2. Allowable HP-IB Bus Messages

OPERATION	DESCRIPTION	9825A EXAMPLE
Data	Initiate a measurement. Read measurement data from instrument.	28: wrt 710,"R1M1E" 30: red 710,A,B
Clear (DCL)	Returns 4943A or 4944A to following setup: Normal Level & Frequency 1004 Hz Display Level Master-to-Slave No Self Check Non-Stop C-Message-Filter NLD Normal Test	34: clr 7
Remote	Enables remote operation of devices on bus. Enables remote operation of only 4943A or 4944A on bus.	37: rem 7 40: rem 710
Local (GTL)	Returns the 4943A or 4944A to local control when addressed.	43: lcl 710
Clear Lockout/ Set Local	Sets local mode on all bus devices.	47: lcl 7 or Press RESET key
Abort (IFC)	Clears all bus operations. Unaddresses all talkers and listeners.	50: cli 7 or Press RESET key
Checking Status Byte for Service Request (SRQ)	Determine if service has been requested by any device. Variable S will contain the byte. Bit 7 contains the status bit.	53: rds(7)→S 54: if bit(7,S)=1;re%
Serial Polling of 4943A or 4944A	Enter status byte from 4943A or 4944A and check for presence of service request. Variable Q will contain the decimal equivalent of the byte. The decimal equivalent is "80" for 4943A and 4944A when service requested.	58: rds(710)→Q 59: if Q=80;sto +10

Table 3. Timing Considerations

ACTION	RECOMMENDED MAXIMUM DELAYS *Note 1*	9825A EXAMPLE
Address TIMS to "listen" to remote enable	1/2 second	65: rem 7 66: wrt 710 67: wait 500 or 70: rem 710 71: wait 500
Set measurement, normal mode.	2 seconds, except NLD, use 20 seconds	74: wrt 710,"R0M1D1F1004O0E" 75: wait 2000
Set measurement, master-slave mode, master-to-slave	10 seconds, except NLD, use 40 seconds	78: wrt 710,"R1M1D1F1004O0E" 79: wait 10000
Set measurement, master-slave mode, slave-to-master	10 seconds, except NLD, use 40 seconds	82: wrt 710,"R2M1D1F1004O0E" 83: wait 10000
Level zero, normal mode	1/4 second	86: wrt 710,"Z0E" 87: wait 250
Level zero, master-slave mode	2 seconds	90: wrt 710,"Z0E" 91: wait 2000
Delay zero, normal mode	1/2 second	94: wrt 710,"Z1E" 95: wait 500
Delay zero, master-slave mode	1/2 second	99: wrt 710,"Z1E" 100: wait 500
NLD check signal, normal mode	20 seconds	101: wrt 710,"N1E" 102: wait 20000
Change transmit frequency	2 seconds	103: fmt 1,"F",f10.0,"E" 104: for N=204 to 3804 by 200 105: wrt 710.1,N 106: wait 2000 107: next N
Start self check	100 seconds for standard 4943A 120 seconds for 4943A – opt 012 or 4944A	110: wrt 710,"C1E" 111: wait 30000 112: wait 30000 113: wait 30000 114: wait 10000 115: red 710,A
Issue bus commands Local, Clear, and Abort	2 seconds	119: cli 7 120: wait 2000

NOTE: 1. The delay values recommended are usually needed to allow TIMS to settle, and to prevent erroneous data entry. The delays presented are therefore typical maximum values. The user is encouraged to try shorter delay times when system efficiency is needed.

Table 4. HP-IB Output Data Format (1 of 2)

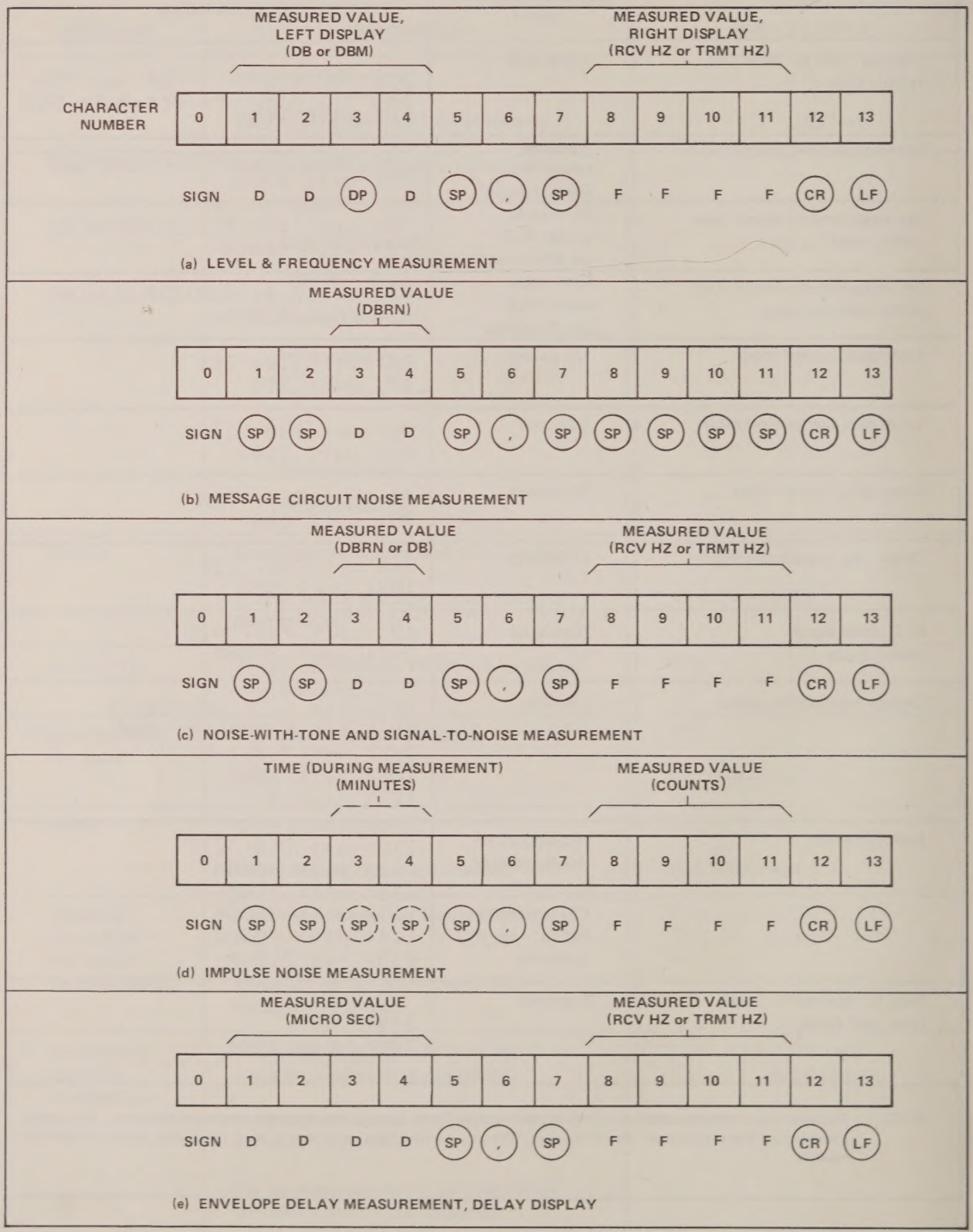
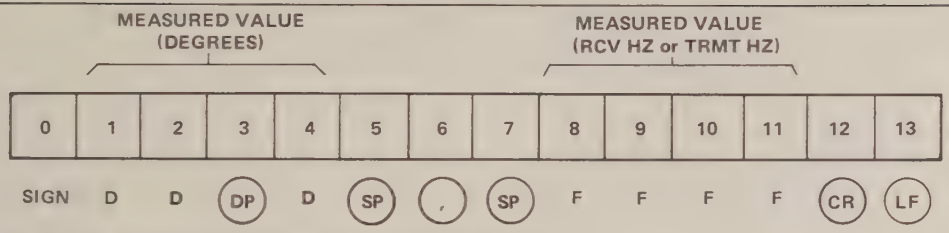
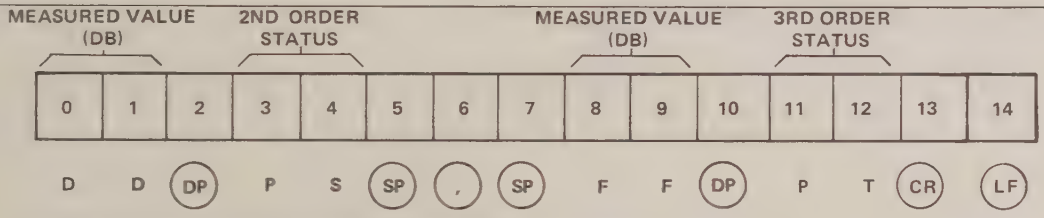

MEASURED VALUE, LEFT DISPLAY (DB or DBM)
MEASURED VALUE, RIGHT DISPLAY (RCV HZ or TRMT HZ)
CHARACTER NUMBER
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN D D DP D SP , SP F F F F CR LF
(a) LEVEL & FREQUENCY MEASUREMENT
MEASURED VALUE (DBRN)
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN SP SP D D SP , SP SP SP SP SP CR LF
(b) MESSAGE CIRCUIT NOISE MEASUREMENT
MEASURED VALUE (DBRN or DB)
MEASURED VALUE (RCV HZ or TRMT HZ)
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN SP SP D D SP , SP F F F F CR LF
(c) NOISE-WITH-TONE AND SIGNAL-TO-NOISE MEASUREMENT
TIME (DURING MEASUREMENT) (MINUTES)
MEASURED VALUE (COUNTS)
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN SP SP SP SP SP , SP F F F F CR LF
(d) IMPULSE NOISE MEASUREMENT
MEASURED VALUE (MICRO SEC)
MEASURED VALUE (RCV HZ or TRMT HZ)
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN D D D D SP , SP F F F F CR LF
(e) ENVELOPE DELAY MEASUREMENT, DELAY DISPLAY

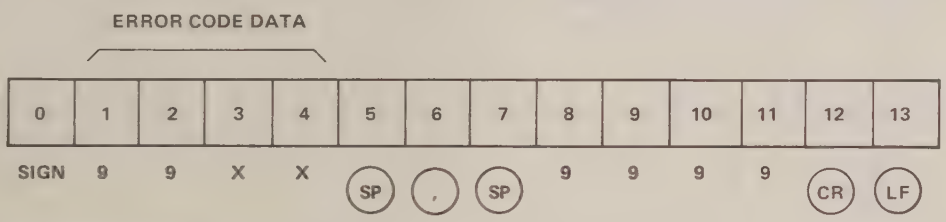
Table 4. HP-IB Output Data Format (2 of 2)



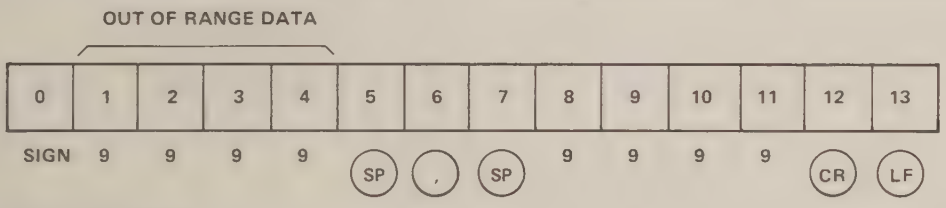
(f) PHASE JITTER MEASUREMENT (STANDARD 4943A ONLY)



(g) NONLINEAR DISTORTION MEASUREMENT (4944A OR 4943A – OPT 012)



(h) ERROR CODES



(i) OUT OF RANGE

NOTES:

(SP) IS AN ASCII SPACE.

(CR) IS AN ASCII CARRIAGE RETURN.

(LF) IS AN ASCII LINE FEED.

(,) IS AN ASCII COMMA USED TO SEPARATE CHARACTER GROUPS.

(DP) IS A DECIMAL POINT.

"SIGN" IS A SPACE (+) OR MINUS (–).

"D" IS LEFT DISPLAY DATA.

"F" IS RIGHT DISPLAY DATA.

"P" IS A NUMERICAL CODE 0 TO 7:

0		4 TONE CORRECTED
1		4 TONE NOT CORRECTED
2		2 TONE CORRECTED
3		2 TONE NOT CORRECTED
4	INPROCESS	4 TONE CORRECTED
5	INPROCESS	4 TONE NOT CORRECTED
6	INPROCESS	2 TONE CORRECTED
7	INPROCESS	2 TONE NOT CORRECTED

"S" IS A NUMERICAL CODE 0 TO 2:

0 2ND DISTORTION READING
1 2ND DISTORTION UNDERRANGE
2 NOISE READING
3 NOISE UNDERRANGE

"T" IS NUMERICAL CODE 0 TO 2:

0 3RD DISTORTION READING
1 3RD DISTORTION UNDERRANGE
2 NOISE READING
3 NOISE UNDERRANGE

Table 5. Status Byte

(LSB)

BIT	7	6	5	4	3	2	1	Ø
	Ø	SERVICE REQUEST	Ø	DATA READY	Ø	Ø	Ø	Ø

- Bits Ø thru 3, 5, and 7 are always logical zero.
- Bits 4 and 6 are logical 1 when the 4943A or 4944A is ready to output data, or when the 4943A or 4944A pulls service request.

SAMPLE MASTER-SLAVE PROGRAM (1 OF 40)
INTRODUCTION

PURPOSE: Using remote master-slave operation, measure all circuit parameters for both directions of transmission. Implement the SF skip function with the program software.

TECHNIQUE:

1. Use the 9825A Calculator to control the master unit using the HP-IB remote interface bus. Print test results with the 9866B Printer.
2. For each measurement parameter, test the master-to-slave direction first, then the slave-to-master direction.
3. Make Level & Frequency measurement from 204 to 3804 Hz in 200 Hz steps. Skip 2604 Hz.
4. Set Impulse Noise for 5 minute period.
5. Make Envelope Delay measurements between 504 and 3204 Hz in 100 Hz steps. Skip 2504, 2604, and 2704 Hz. Execute delay zero mathematically at the frequency of minimum delay.
6. Check for possible error conditions such as H-codes, out of range (over or under range), and frequency transmission errors.
7. If an error condition exists, then print the error, stop the measurement, and try the measurement again. If the measurement fails 3 times, then give up and go to the next measurement (ie., L & F, M-to-S fails 3 times, go to L & F, S-to-M).
8. If initial 1004 Hz link-up fails, 3 times in a row, then abort test.
9. An underrange is acceptable as normal data in Level & Frequency, after the initial 1004 Hz link-up.
10. An underrange is acceptable as normal data in Message Circuit Noise, Noise-with-Tone, and Signal-to-Noise.
11. An underrange is acceptable as normal data in Envelope Delay, after the 1804 Hz link-up.

RUNNING TIME: About 15 minutes, with no error conditions.

REMINDER: At both slave and master units, set TRANSMITTER OUTPUT LEVEL (in NORMAL mode) before beginning Master-Slave operation. At slave unit, don't forget to set REMOTE switch to SLAVE position, after transmit levels are set.

9825A NOTES:

1. The program uses the Advance Programming ROM, giving FOR-NEXT loop capability.
2. The General and Extended I/O ROMS needed for HP-IB control.
3. The 98034A HP-IB Interface Kit (Select code 7) needed for HP-IB interface.
4. The 98032A Option 066 Interface (Select code 6) needed to interface the 9825A and 9866B.
5. This program uses about 8000 bytes of 9825A user memory.

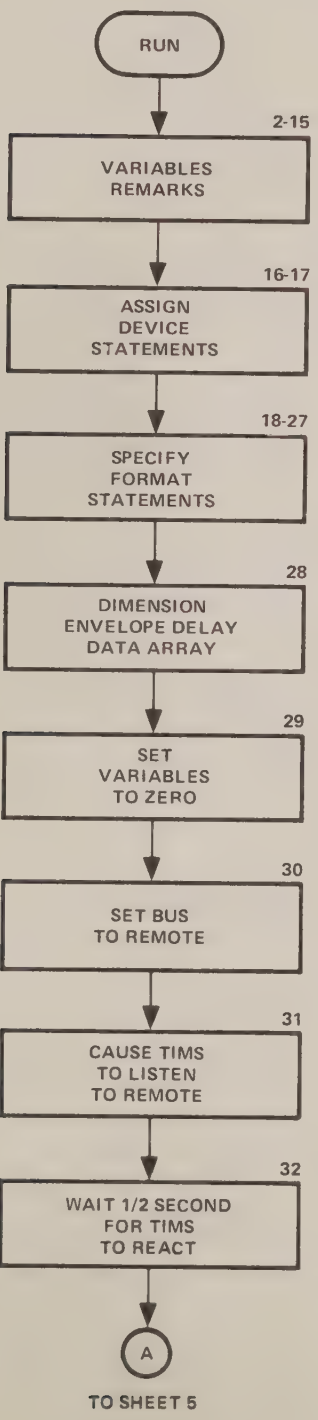
PRESENTATION TECHNIQUE:

A complete program listing is given in the following pages. Opposite each program segment is a corresponding flow chart. A line description begins on sheet 30 (page 40). This line description provides a more in-depth description of certain program segments. A line number is referenced for each description.

SAMPLE MASTER-SLAVE PROGRAM (2 OF 40)
REMARKS, FORMAT STATEMENTS AND SET BUS TO REMOTE

```
0: "REMARK:  BEGIN MASTER-SLAVE SAMPLE PROGRAM-MODEL 4943A":
1: "1 DEC 77 - File #1":
2: "REMARK:  Variables Assignment:":
3: "REMARK:    A used for left display data":
4: "REMARK:    B used for right display data":
5: "REMARK:    N used for frequency step loop":
6: "REMARK:    T used for measurement indicator":
7: "REMARK:    X used for error counter":
8: "REMARK:    U used as env. del. zero  reference":
9: "REMARK:    V used as env.  del. zero frequency":
10: "REMARK:   D is array variable for e.d. data table":
11: "REMARK:   J is array variable for delay values":
12: "REMARK:   K is array variable for freq. values":
13: "REMARK:   W  used for 6 minute loop":
14: "REMARK:   F is FREQ STEP subroutine status":
15: "REMARK:   G is E.D. DATA subroutine status":
16: dev "TIMS",710
17: dev "PRTER",6
18: fmt 0
19: fmt 1,"F",f10.0,"E"
20: fmt 2,4x,f10.1,4x,"DB    AT",x,f8.0,x,"HZ"
21: fmt 3,10x,"ERROR CODE H-",f2.0,x,"PRESENT"
22: fmt 4,4x,f10.0,x,"DBRN --- C-MSG FILT"
23: fmt 5,4x,f10.0,4x,"DB   AT",x,f8.0,x,"HZ --- C-MSG FILT"
24: fmt 6,4x,f10.0,x,"COUNTS IN 5 MINUTES --- C-MSG FILT"
25: fmt 7,4x,f10.0,4x,"MICRO   SEC   AT",x,f8.0,x,"HZ"
26: fmt 8,4x,f10.1,4x,"DEGREES P-P"
27: fmt 9,4x,"UNDERRANGE"
28: dim D[30,2]
29: 0→A→B→N→T→X→U→V→D→J→K→W→F→G
30: rem 7
31: wrt "TIMS"
32: wait 500
```

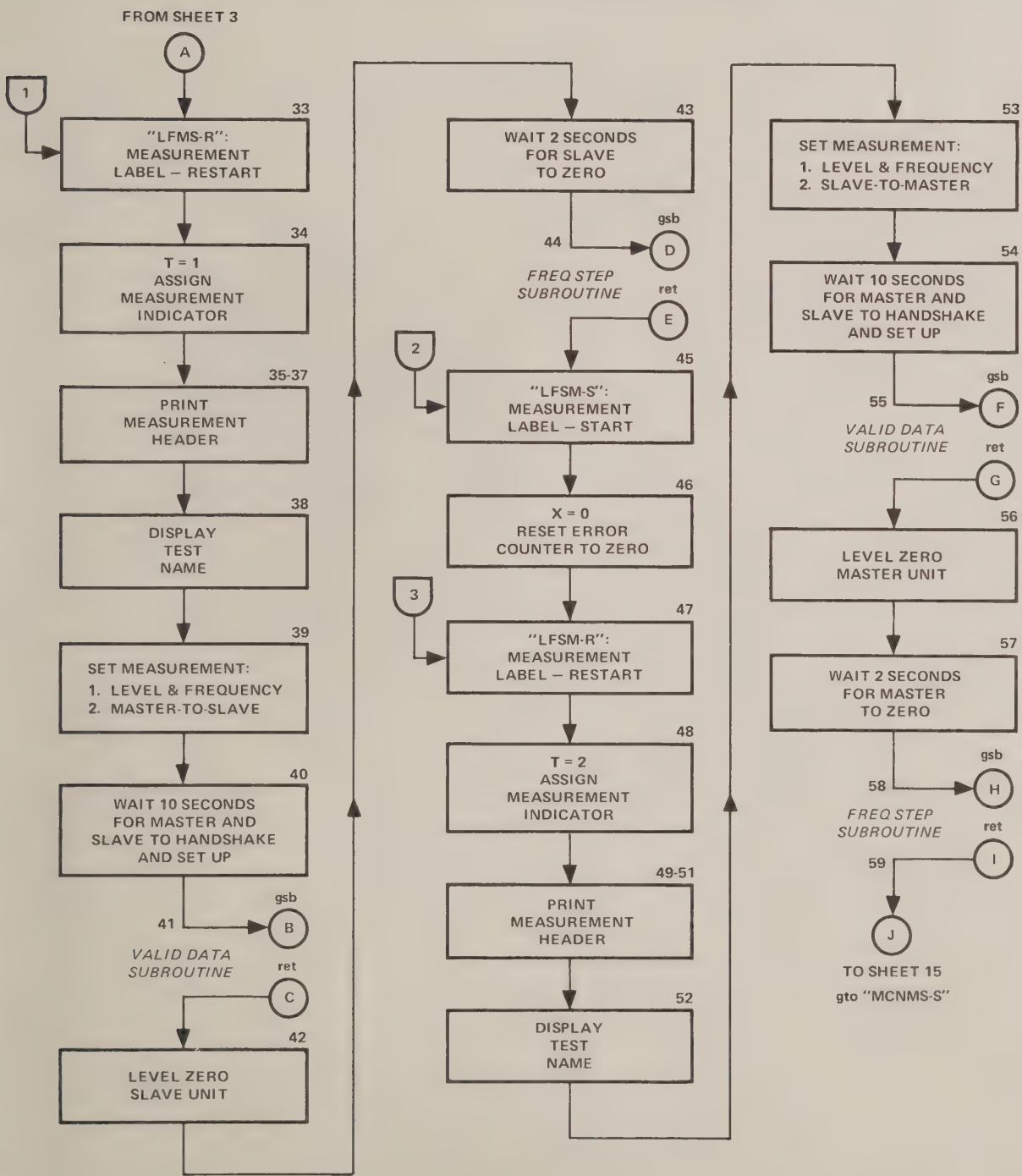
SAMPLE MASTER-SLAVE PROGRAM (3 OF 40)
REMARKS, FORMAT STATEMENTS AND SET BUS TO REMOTE



SAMPLE MASTER-SLAVE PROGRAM (4 OF 40)
LEVEL & FREQUENCY MEASUREMENT

```
33: "LFMS-R":
34: 1→T
35: wtb "PRTER",10,10
36: wrt "PRTER","LEVEL & FREQUENCY TEST, MASTER-TO-SLAVE DIRECTION"
37: wtb "PRTER",10
38: dsp "LEV & FREQ, M-TO-S: IN PROGRESS"
39: wrt "TIMS","R1M1D1F100400E"
40: wait 10000
41: esb "VALID DATA"
42: wrt "TIMS","Z0E"
43: wait 2000
44: esb "FREQ STEP"
45: "LFSM-S":
46: 0→X
47: "LFSM-R":
48: 2→T
49: wtb "PRTER",10,10
50: wrt "PRTER","LEVEL & FREQUENCY TEST, SLAVE-TO-MASTER DIRECTION"
51: wtb "PRTER",10
52: dsp "LEV & FREQ, S-TO-M: IN PROGRESS"
53: wrt "TIMS","R2M1D1F100400E"
54: wait 10000
55: esb "VALID DATA"
56: wrt "TIMS","Z0E"
57: wait 2000
58: esb "FREQ STEP"
59: eto "MCNMS-S"
```

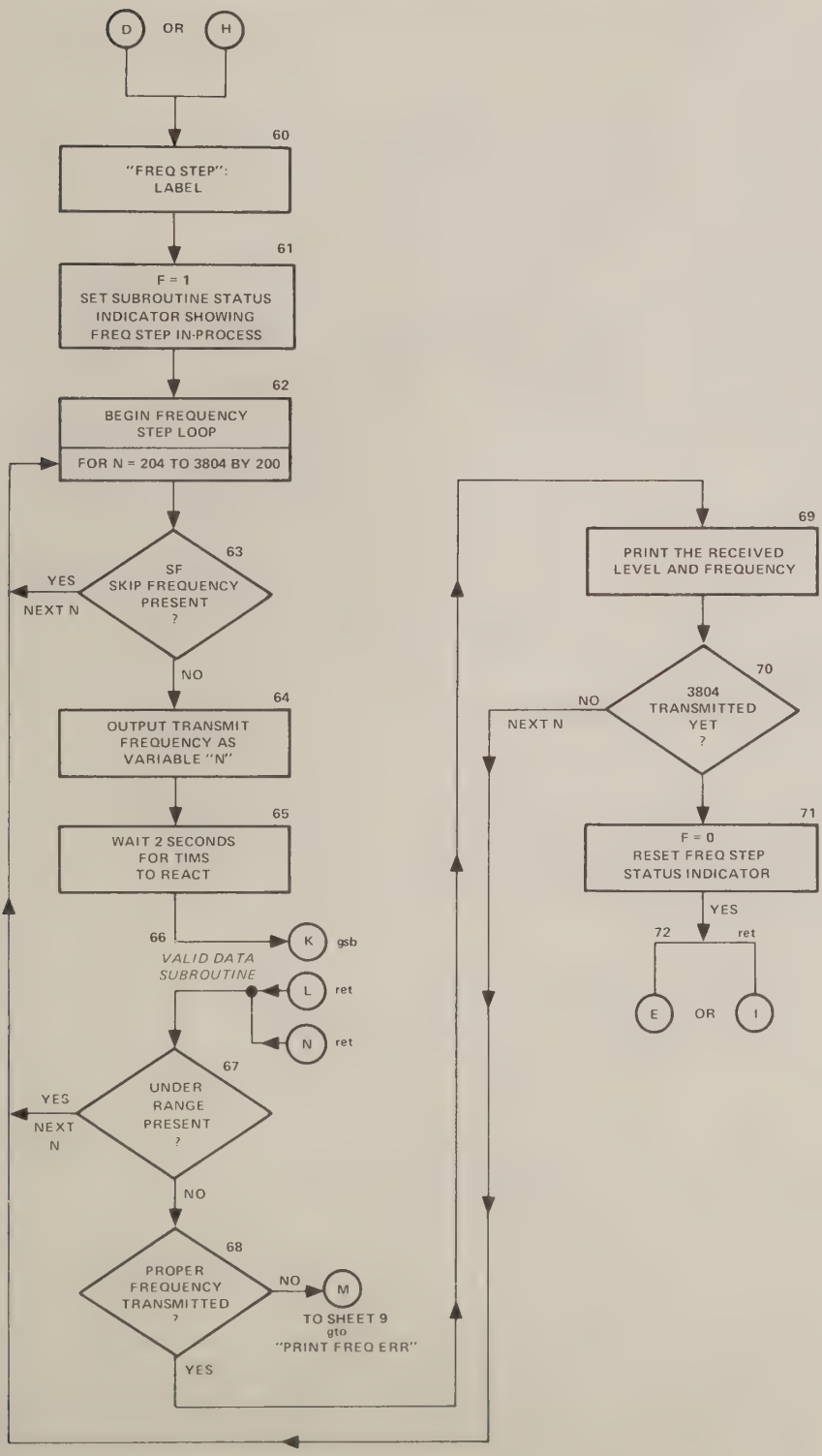
SAMPLE MASTER-SLAVE PROGRAM (5 OF 40)
LEVEL & FREQUENCY MEASUREMENT



SAMPLE MASTER-SLAVE PROGRAM (6 OF 40)
FREQUENCY STEP SUBROUTINE

```
60: "FREQ STEP":
61: 1→F
62: for N=204 to 3804 by 200
63: if N=2604;next N
64: wrt "TIMS.1",N
65: wait 2000
66: ssb "VALID DATA"
67: if A=-9999 or A=9910;sto +3
68: if B>=N+10 or B<=N-10;sto "PRINT FREQ ERR"
69: wrt "PRTER.2",A,B
70: next N
71: 0→F
72: ret
```

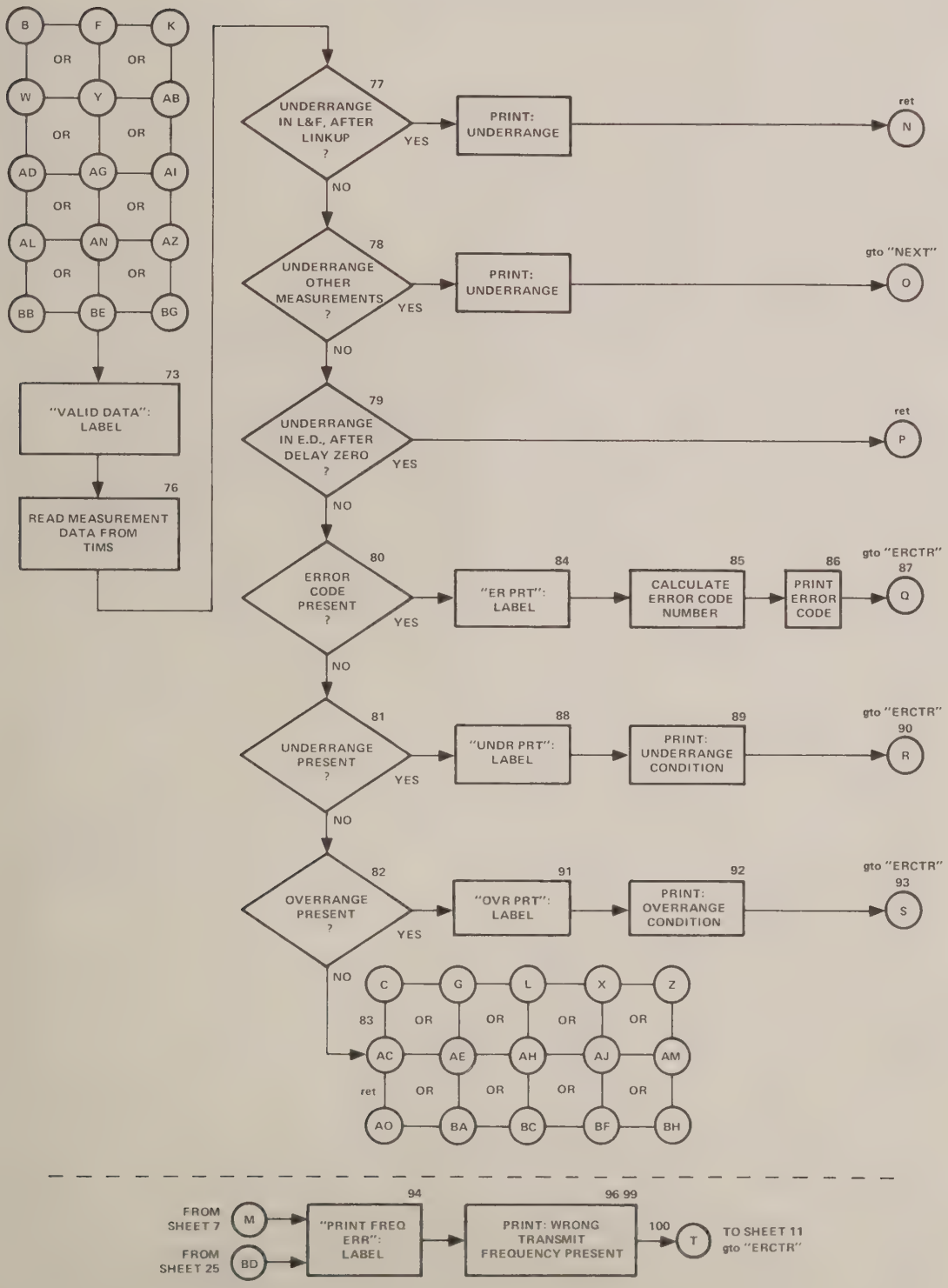
SAMPLE MASTER-SLAVE PROGRAM (7 OF 40)
FREQUENCY STEP SUBROUTINE



SAMPLE MASTER-SLAVE PROGRAM (8 OF 40)
VALID DATA DETECTION SUBROUTINE

```
73: "VALID DATA":
74: "REMARK:  Check for  presence of valid data":
75: "REMARK:  before continuing main program":
76: red "TIMS.0",A,B
77: if (A=-9999 or A=9910) and (T=1 or T=2) and F=1;wrt "PRTER.9";ret
78: if (A=-9999 or A=9910) and (T>2 and T<9);wrt "PRTER.9";gto "NEXT"
79: if (A=-9999 or A=9910) and (T=11 or T=12) and G=1;ret
80: if A>=9900 and A<=9916;gto "ER PRT"
81: if A=-9999;gto "UNDR PRT"
82: if A=9999;gto "OVR PRT"
83: ret
84: "ER PRT":
85: A-9900→A
86: wrt "PRTER.3",A
87: gto "ER CTR"
88: "UNDR PRT":
89: wrt "PRTER","    UNDERRANGE CONDITION PRESENT"
90: gto "ER CTR"
91: "OVR PRT":
92: wrt "PRTER","    OVERRANGE CONDITION PRESENT"
93: gto "ER CTR"
94: "PRINT FREQ ERR":
95: "REMARK:  Begin frequency error print subroutine":
96: wtb "PRTER",10
97: wrt "PRTER","WRONG TRANSMIT FREQUENCY PRESENT-"
98: wrt "PRTER","POSSIBLE SIGNAL DROPOUT"
99: wtb "PRTER",10
100: gto "ER CTR"
```

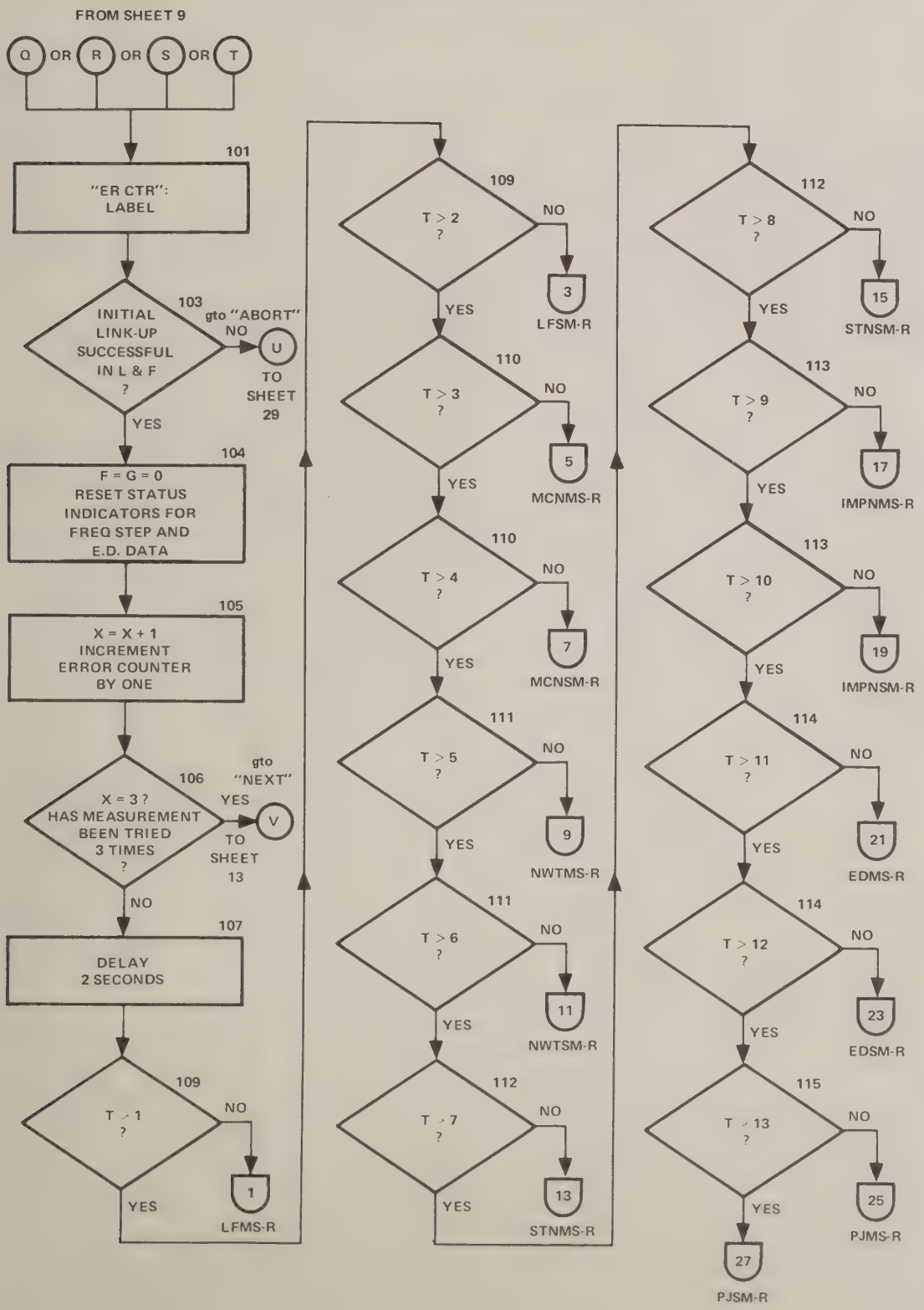
SAMPLE MASTER-SLAVE PROGRAM (9 OF 40)
VALID DATA DETECTION SUBROUTINE



SAMPLE MASTER-SLAVE PROGRAM (10 OF 40)
ERROR COUNTER SUBROUTINE

```
101: "ER CTR":
102: "REMARK:  Begin Error Counter":
103: if T=1 and F=0 and X=2;gto "ABORT"
104: 0→F→G
105: X+1→X
106: if X=3;gto "NEXT"
107: wait 2000
108: "REMARK: Tr: the measurement again":
109: gto "LFMS-R";if T>1;gto "LFSM-R";if T>2;gto +1
110: gto "MCNMS-R";if T>3;gto "MCNSM-R";if T>4;gto +1
111: gto "NWTMS-R";if T>5;gto "NWTSM-R";if T>6;gto +1
112: gto "STNMS-R";if T>7;gto "STNSM-R";if T>8;gto +1
113: gto "IMPNMS-R";if T>9;gto "IMPNSM-R";if T>10;gto +1
114: gto "EDMS-R";if T>11;gto "EDSM-R";if T>12;gto +1
115: gto "PJMS-R";if T>13;gto "PJSM-R"
```

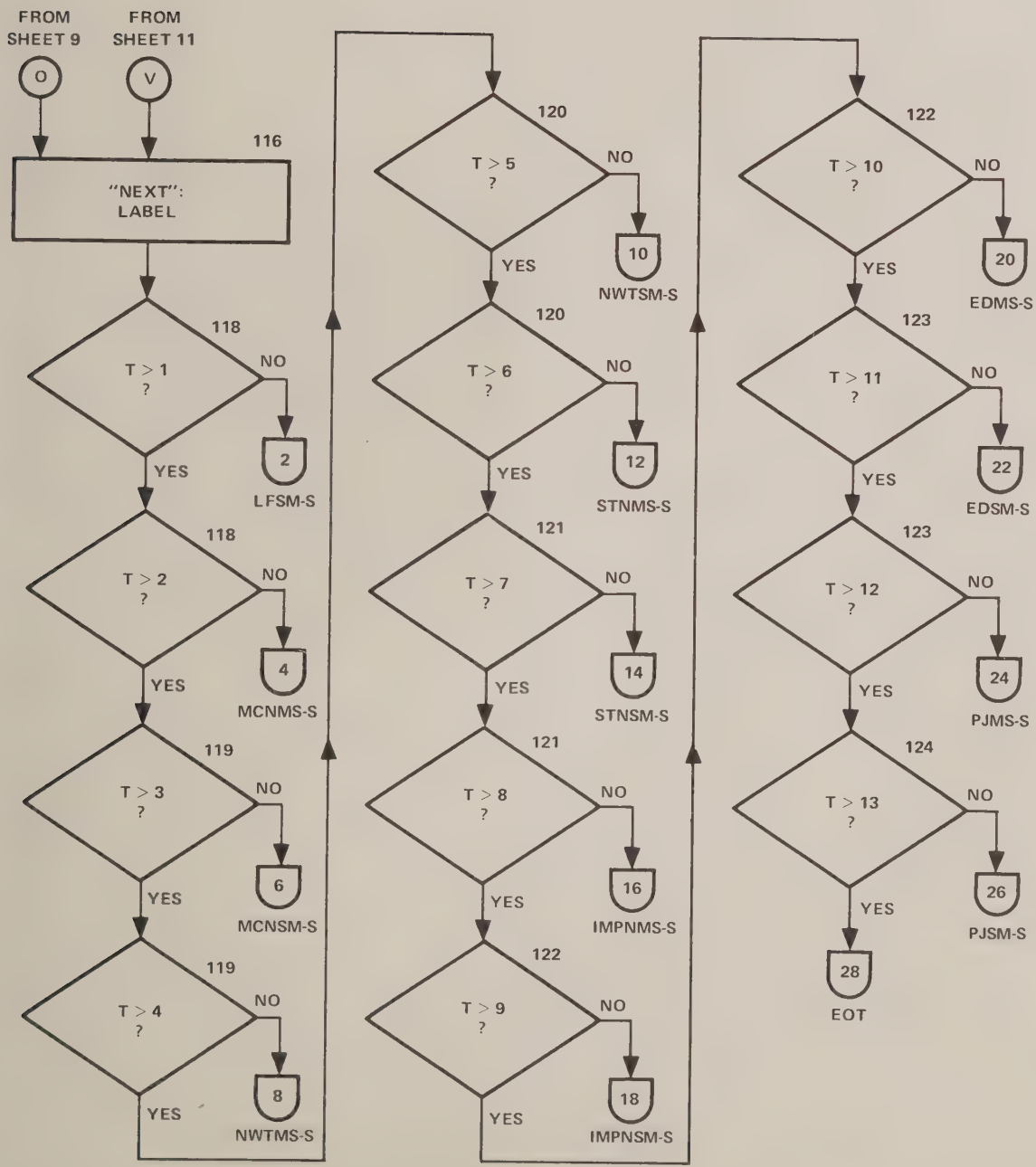
SAMPLE MASTER-SLAVE PROGRAM (11 OF 40)
ERROR COUNTER SUBROUTINE



SAMPLE MASTER-SLAVE PROGRAM (12 OF 40)
ERROR COUNTER SUBROUTINE

```
116: "NEXT":
117: "REMARK: Try the next measurement":
118: gto "LFSM-S";if T>1;gto "MCNMS-S";if T>2;gto +1
119: gto "MCNSM-S";if T>3;gto "NWTMS-S";if T>4;gto +1
120: gto "NWTSM-S";if T>5;gto "STNMS-S";if T>6;gto +1
121: gto "STNSM-S";if T>7;gto "IMPNMS-S";if T>8;gto +1
122: gto "IMPNSM-S";if T>9;gto "EDMS-S";if T>10;gto +1
123: gto "EDSM-S";if T>11;gto "PJMS-S";if T>12;gto +1
124: gto "PJSM-S";if T>13;gto "EOT"
```

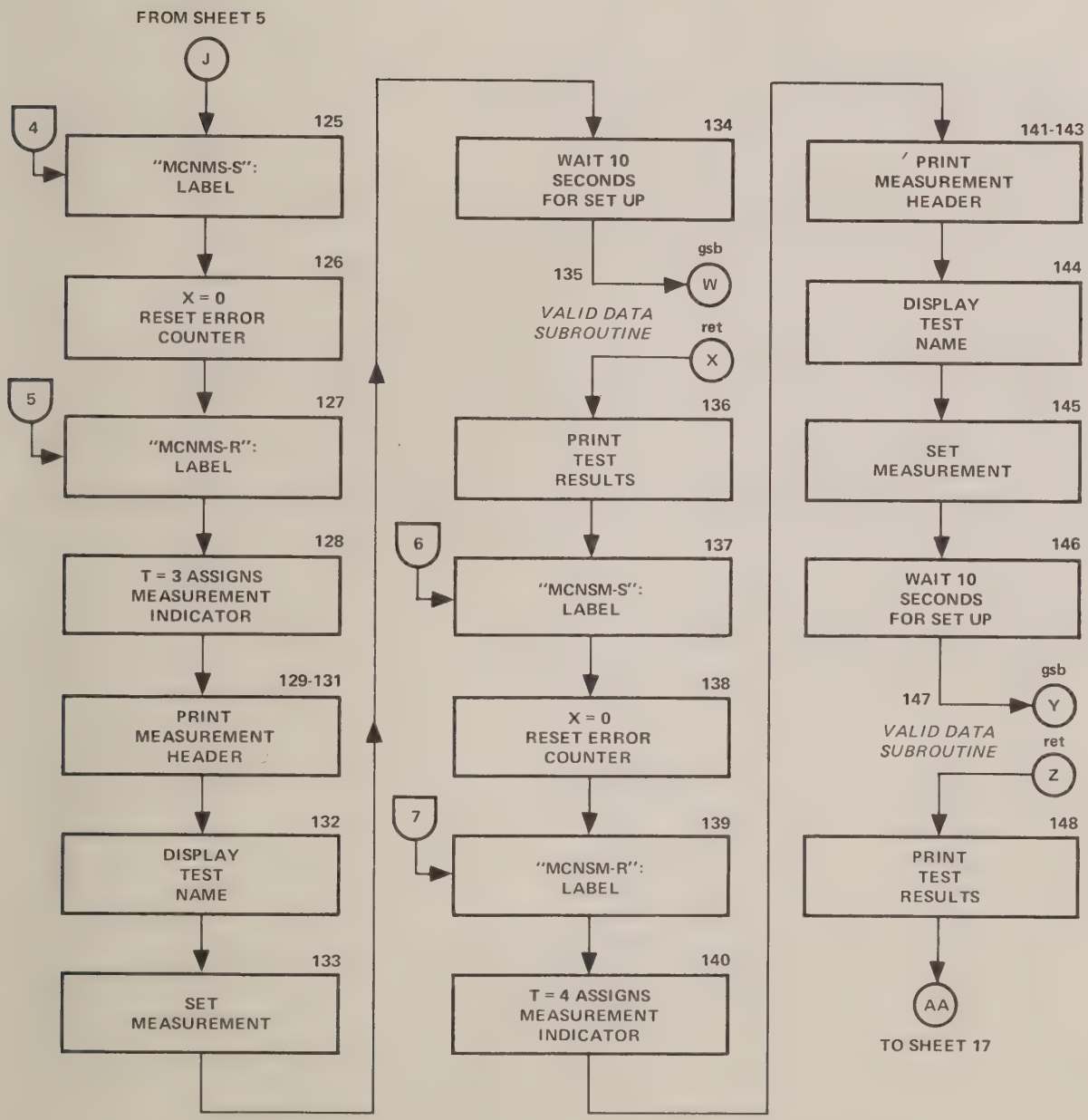
SAMPLE MASTER-SLAVE PROGRAM (13 OF 40)
ERROR COUNTER SUBROUTINE



SAMPLE MASTER-SLAVE PROGRAM (14 OF 40)
MESSAGE CIRCUIT NOISE MEASUREMENT

```
125: "MCNMS-S":
126: 0→X
127: "MCNMS-R":
128: 3→T
129: wtb "PRTER",10,10
130: wrt "PRTER","MESSAGE CKT NOISE TEST, MASTER-TO-SLAVE DIRECTION"
131: wtb "PRTER",10
132: dsp "MSG CKT NOISE,M-TO-S:IN PROGRESS"
133: wrt "TIMS","R1M2W0E"
134: wait 10000
135: asb "VALID DATA"
136: wrt "PRTER,4",A
137: "MCNSM-S":
138: 0→X
139: "MCNSM-R":
140: 4→T
141: wtb "PRTER",10,9
142: wrt "PRTER","MESSAGE CKT NOISE TEST, SLAVE-TO-MASTER DIRECTION"
143: wtb "PRTER",10
144: dsp "MSG CKT NOISE,S TO M:IN PROGRESS"
145: wrt "TIMS","R2M2W0E"
146: wait 10000
147: asb "VALID DATA"
148: wrt "PRTER,4",A
```

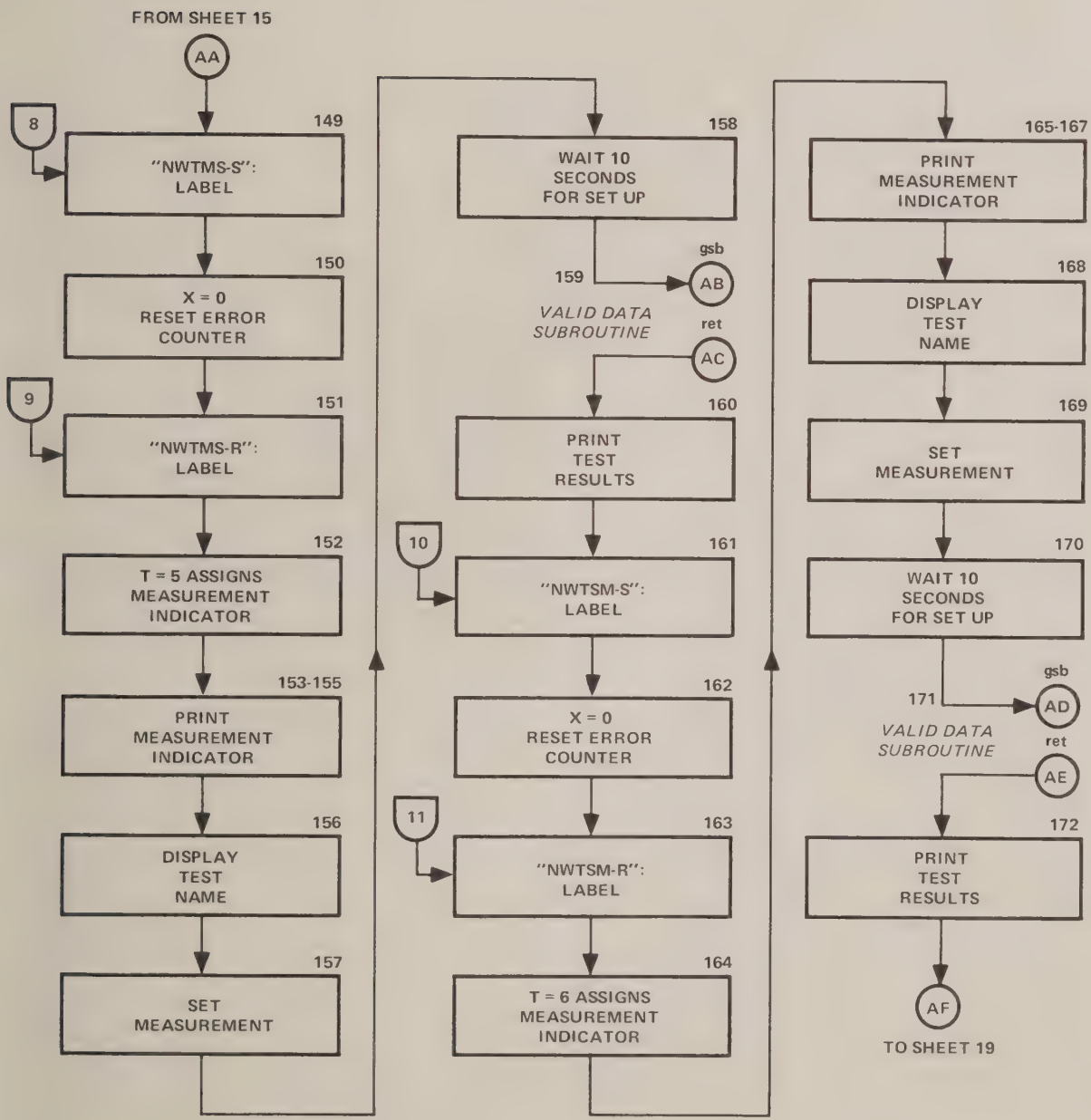
SAMPLE MASTER-SLAVE PROGRAM (15 OF 40)
MESSAGE CIRCUIT NOISE MEASUREMENT



SAMPLE MASTER-SLAVE PROGRAM (16 OF 40)
NOISE-WITH-TONE MEASUREMENT

```
149: "NWTMS-S":
150: 0→X
151: "NWTMS-R":
152: 5→T
153: wtb "PRTER",10,10
154: wrt "PRTER","NOISE-WITH-TONE TEST, MASTER-TO-SLAVE DIRECTION"
155: wtb "PRTER",10
156: dsp "N-W-T, M TO-S: IN PROGRESS"
157: wrt "TIMS","K2M3E"
158: wait 10000,
159: esb "VALID DATA"
160: wrt "PRTER,4",A
161: "NWTSM-S":
162: 0→X
163: "NWTSM-R":
164: 6→T
165: wtb "PRTER",10,10
166: wrt "PRTER","NOISE-WITH-TONE TEST, SLAVE-TO-MASTER DIRECTION"
167: wtb "PRTER",10
168: dsp "N-W-T, S-TO-M: IN PROGRESS"
169: wrt "TIMS","K2M3E"
170: wait 10000
171: esb "VALID DATA"
172: wrt "PRTER,4",A
```

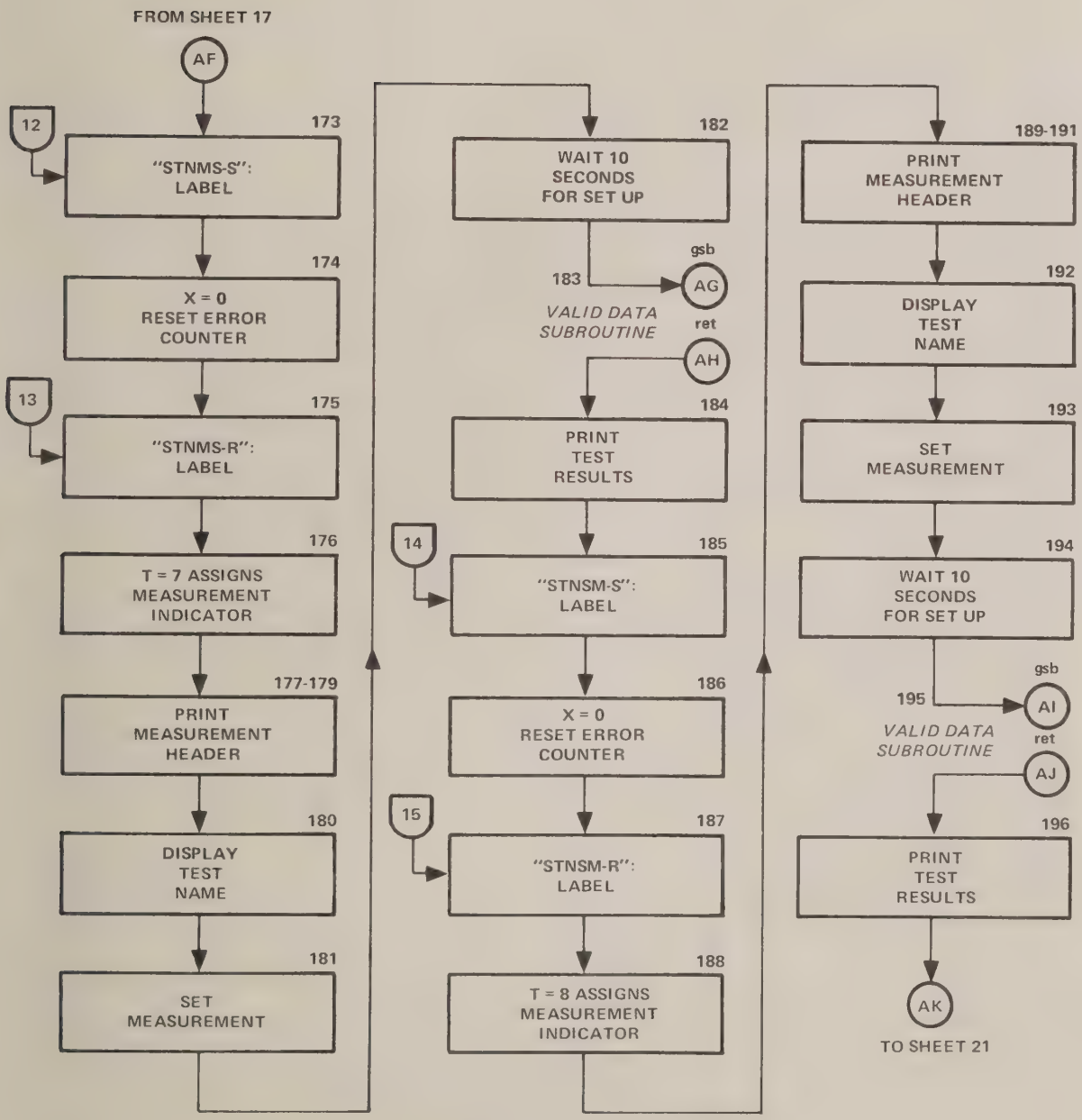
SAMPLE MASTER-SLAVE PROGRAM (17 OF 40)
NOISE-WITH-TONE MEASUREMENT



SAMPLE MASTER-SLAVE PROGRAM (18 OF 40)
SIGNAL-TO-NOISE MEASUREMENT

```
173: "STNMS-S":
174: 0→X
175: "STNMS-R":
176: 7→T
177: wtb "PRTER",10,10
178: wrt "PRTER","SIGNAL-TO-NOISE TEST, MASTER-TO-SLAVE DIRECTION"
179: wtb "PRTER",10
180: dsp "S-TO-N, M-TO-S: IN PROGRESS"
181: wrt "TIMS","R1M4E"
182: wait 10000
183: esb "VALID DATA"
184: wrt "PRTER.5",A,B
185: "STNSM-S":
186: 0→X
187: "STNSM-R":
188: 8→T
189: wtb "PRTER",10,10
190: wrt "PRTER","SIGNAL-TO-NOISE TEST, SLAVE-TO-MASTER DIRECTION"
191: wtb "PRTER",10
192: dsp "S-TO-N, S-TO-M: IN PROGRESS"
193: wrt "TIMS","R2M4E"
194: wait 10000
195: esb "VALID DATA"
196: wrt "PRTER.5",A,B
```

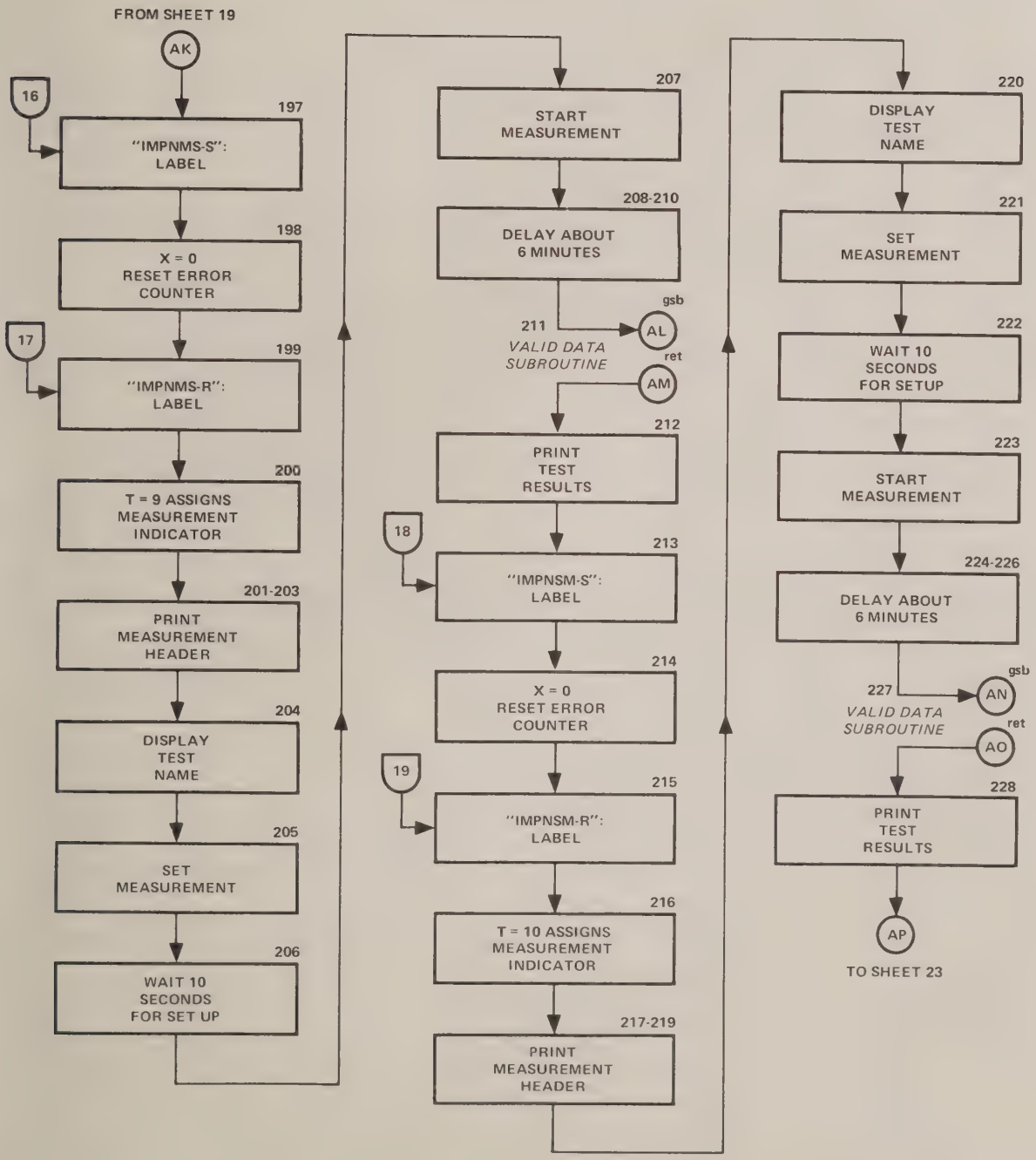
SAMPLE MASTER-SLAVE PROGRAM (19 OF 40)
SIGNAL-TO-NOISE MEASUREMENT



SAMPLE MASTER-SLAVE PROGRAM (20 OF 40)
IMPULSE NOISE MEASUREMENT

```
197: "IMPNMS-S":
198: 0→X
199: "IMPNMS-R":
200: 9→T
201: wtb "PRTER",10,10
202: wrt "PRTER","IMPULSE NOISE TEST, MASTER-TO-SLAVE DIRECTION"
203: wtb "PRTER",10
204: dsp "IMP NOISE, M-TO-S: IN PROGRESS"
205: wrt "TIMS","R1M5P0E"
206: wait 10000
207: wrt "TIMS","I1E"
208: for W=1 to 12
209: wait 30000
210: next W
211: esb "VALID DATA"
212: wrt "PRTER.6",B
213: "IMPNSM-S":
214: 0→X
215: "IMPNSM-R":
216: 10→T
217: wtb "PRTER",10,10
218: wrt "PRTER","IMPULSE NOISE TEST, SLAVE-TO-MASTER DIRECTION"
219: wtb "PRTER",10
220: dsp "IMP NOISE, S-TO-M: IN PROGRESS"
221: wrt "TIMS","R2M5P0E"
222: wait 10000
223: wrt "TIMS","I1E"
224: for W=1 to 12
225: wait 30000
226: next W
227: esb "VALID DATA"
228: wrt "PRTER.6",B
```

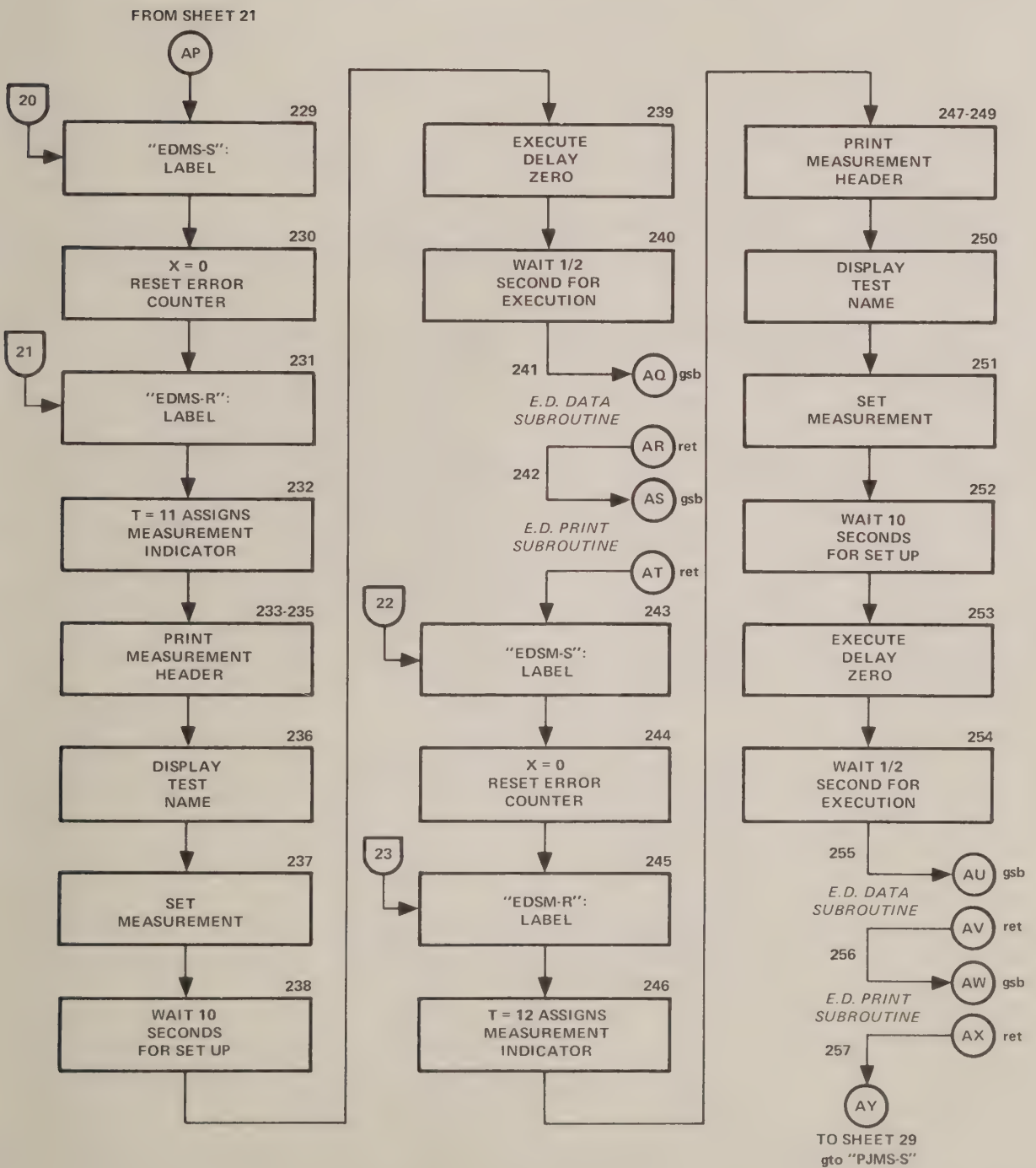
SAMPLE MASTER-SLAVE PROGRAM (21 OF 40)
IMPULSE NOISE MEASUREMENT



SAMPLE MASTER-SLAVE PROGRAM (22 OF 40)
ENVELOPE DELAY MEASUREMENT

```
229: "EDMS-S":
230: 0→X
231: "EDMS-R":
232: 11→T
233: wtb "PRTER",10,10
234: wrt "PRTER","ENVELOPE DELAY TEST, MASTER-TO-SLAVE DIRECTION"
235: wtb "PRTER",10
236: dsp "ENV DEL, M-TO-S: IN PROGRESS"
237: wrt "TIMS","R1M6F1804E"
238: wait 10000
239: wrt "TIMS","Z1E"
240: wait 500
241: asb "E.D. DATA"
242: asb "E.D. PRINT"
243: "EDSM-S":
244: 0→X
245: "EDSM-R":
246: 12→T
247: wtb "PRTER",10,10
248: wrt "PRTER","ENVELOPE DELAY TEST, SLAVE-TO-MASTER DIRECTION"
249: wtb "PRTER",10
250: dsp "ENV DEL, S-TO-M: IN PROGRESS"
251: wrt "TIMS","R2M6F1804E"
252: wait 10000
253: wrt "TIMS","Z1E"
254: wait 500
255: asb "E.D. DATA"
256: asb "E.D. PRINT"
257: ato "PJMS-S"
```

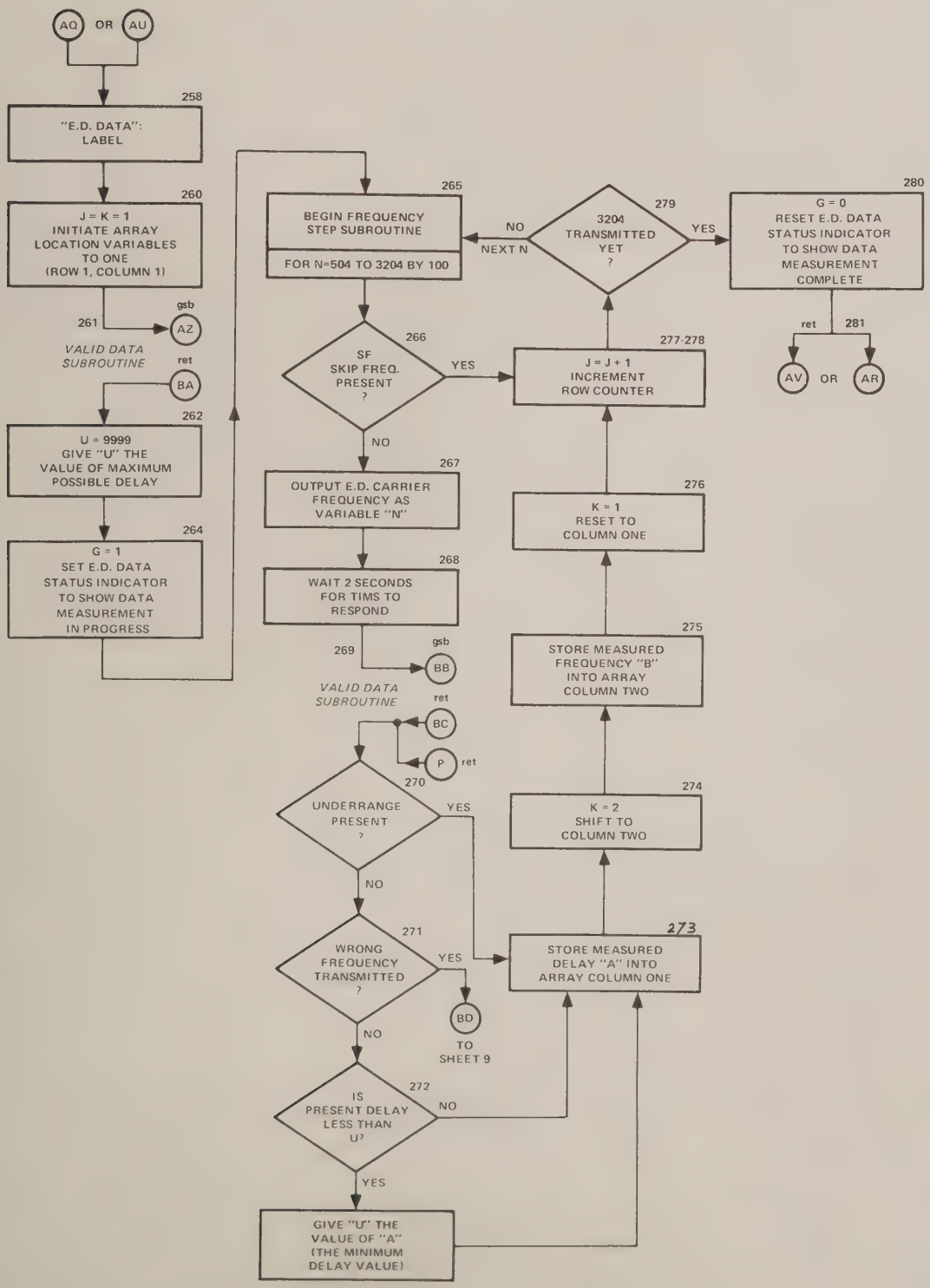
SAMPLE MASTER-SLAVE PROGRAM (23 OF 40)
ENVELOPE DELAY MEASUREMENT



SAMPLE MASTER-SLAVE PROGRAM (24 OF 40)
ENVELOPE DELAY DATA RETRIEVAL SUBROUTINE

```
258: "E.D. DATA":
259: "REMARK:  Begin Env. Del. Data Subroutine":
260: 1→J→K
261: gsb "VALID DATA"
262: 9999→U
263: "REMARK:  U assumes value of max possible delay":
264: 1→G
265: for N=504 to 3204 by 100
266: if N=2504 or N=2604 or N=2704;gto "ROW INCR"
267: wrt "TIMS.1",N
268: wait 2000
269: gsb "VALID DATA"
270: if A=-9999 or A=9910;gto +3
271: if B>=N+10 or B<=N-10;gto "PRINT FREQ ERR"
272: if A<U;A→U;B→V
273: A→D[J,K]
274: 2→K
275: B→D[J,K]
276: 1→K
277: "ROW INCR":
278: J+1→J
279: next N
280: 0→G
281: ret
```

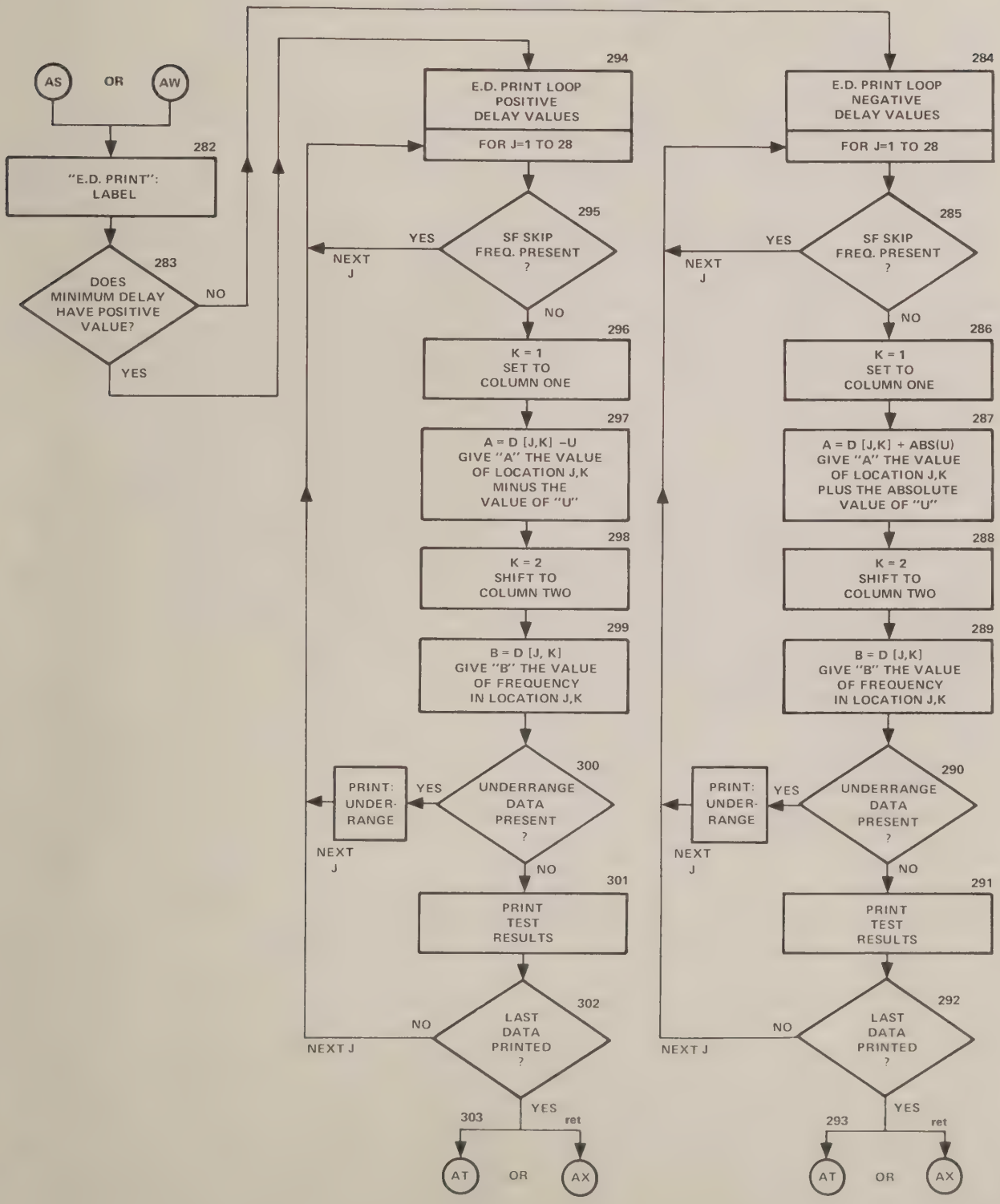
SAMPLE MASTER-SLAVE PROGRAM (25 OF 40)
ENVELOPE DELAY DATA RETRIEVAL SUBROUTINE



SAMPLE MASTER-SLAVE PROGRAM (26 OF 40)
ENVELOPE DELAY PRINT SUBROUTINE

```
282: "E.D. PRINT":
283: if U>0;gto +11
284: for J=1 to 28
285: if J=21 or J=22 or J=23;gto +7
286: 1→K
287: D[J,K]+abs(U)→A
288: 2→K
289: D[J,K]→B
290: if A-abs(U)=-9999 or A-abs(U)=9910;wrt "PRTER.9";gto +2
291: wrt "PRTER.7",A,B
292: next J
293: ret
294: for J=1 to 28
295: if J=21 or J=22 or J=23;gto +7
296: 1→K
297: D[J,K]-U→A
298: 2→K
299: D[J,K]→B
300: if A+U=-9999 or A+U=9910;wrt "PRTER.9";gto +2
301: wrt "PRTER.7",A,B
302: next J
303: ret
```

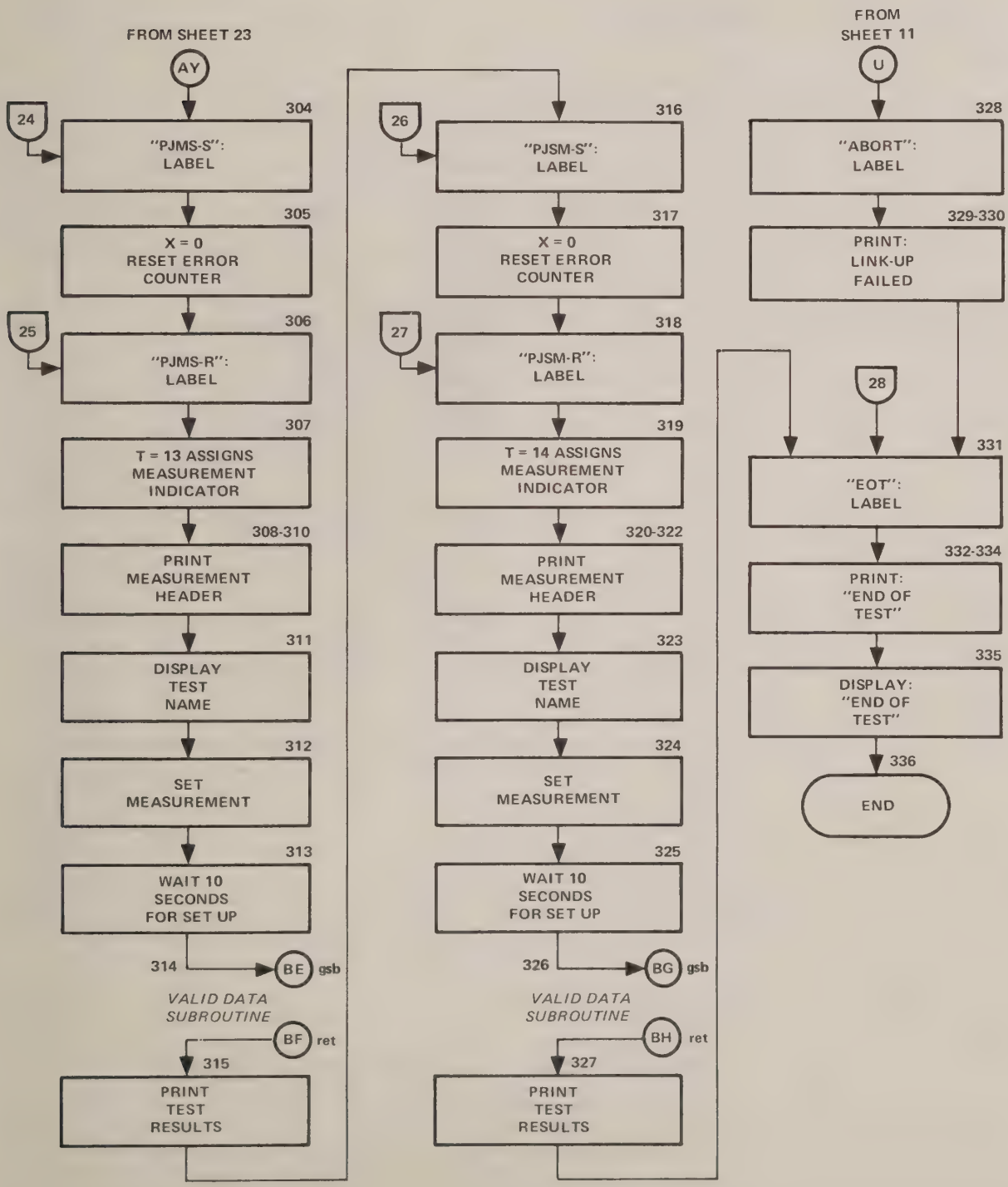
SAMPLE MASTER-SLAVE PROGRAM (27 OF 40)
ENVELOPE DELAY PRINT SUBROUTINE



SAMPLE MASTER-SLAVE PROGRAM (28 OF 40)
PHASE JITTER MEASUREMENT

```
304: "PJMS-S":
305: 0→X
306: "PJMS-R":
307: 13→T
308: wtb "PRTER",10,10
309: wrt "PRTER","PHASE JITTER TEST, MASTER-TO-SLAVE DIRECTION"
310: wtb "PRTER",10
311: dsp "PHASE JITTER,M-TO-S: IN PROGRESS"
312: wrt "TIMS","R1M7E"
313: wait 10000
314: esb "VALID DATA"
315: wrt "PRTER.8",A
316: "PJSM-S":
317: 0→X
318: "PJSM-R":
319: 14→T
320: wtb "PRTER",10,10
321: wrt "PRTER","PHASE JITTER TEST, SLAVE-TO-MASTER  DIRECTION"
322: wtb "PRTER",10
323: dsp "PHASE JITTER,S-TO-M: IN PROGRESS"
324: wrt "TIMS","R2M7E"
325: wait 10000
326: esb "VALID DATA"
327: wrt "PRTER.8",A;gto "EOT"
328: "ABORT":
329: wtb "PRTER",10
330: wrt "PRTER","LINK-UP FAILED, TEST ABORTED"
331: "EOT":
332: wtb "PRTER",10
333: wrt "PRTER","END OF TEST"
334: wtb "PRTER",10,10
335: dsp "END OF TEST"
336: end
*21204
```

SAMPLE MASTER-SLAVE PROGRAM (29 OF 40)
PHASE JITTER MEASUREMENT



SAMPLE MASTER-SLAVE PROGRAM (30 OF 40)
LINE DESCRIPTION

LINE NO.	EXPLANATION
0-15	Remarks.
16	Device statement assigns "TIMS" to address code 710.
17	Device statement assigns "PRTER" to select code 6.
18	Free field format statement used for entering data from TIMS to 9825A via HP-IB.
19	Format statement used to output the transmit frequency in Level and Frequency and Envelope Delay.
20-27	Format statements used to print measured data with appropriate units.
28	Dimensions array for storing measured envelope delay data.
29	Assigns the value of zero to all variables.
30	Sets bus to remote.
31	Causes TIMS to "listen" so it will "hear" the remote condition and react.
32	Wait 1/2 second for TIMS to react to remote.
33	The program label denoting the (L) Level and (F) Frequency measurement, (M) Master-to-(S) Slave direction. The R suffix denotes this label as a restart label, e.g., a location to which the program returns, to restart the measurement after an error condition.
34	Assign measurement indicator so error counter will know which measurement is in progress. T=1 is Level & Frequency, Master-to-Slave direction.
35	Outputs two line feeds to printer.
36	Prints measurement header.
37	Outputs one line feed to printer.
38	Display on the calculator display the name of the measurement in progress.
39	Set the measurement in TIMS.
40	Wait 10 seconds for master and slave to handshake, and for both to set up.
41	Go to valid data detection subroutine.
42	Level zero the slave unit.

SAMPLE MASTER-SLAVE PROGRAM (31 OF 40)
LINE DESCRIPTION

LINE NO.	EXPLANATION
43	Wait 2 seconds for slave to zero.
44	Go to frequency step subroutine.
45	The program label denoting (L) Level & (F) Frequency, (S) Slave-to-(M) Master direction, (S) Start the measurement for the first time at this location.
46	Reset the error counter to zero for this measurement. This is so the error counter will know that this is the first time this measurement has been attempted.
47	The program label denoting (L) Level & (F) Frequency, (S) Slave-to-(M) Master direction, (R) Restart the Measurement at this location. Restarting the program here (rather than at line 45) prevents resetting "X" to zero, and retains the error count.
48	Assigns measurement indicator.
49-51	Prints measurement header.
52	Display measurement name.
53	Set the measurement in TIMS.
54	Wait 10 seconds for handshake and set-up.
55	Go to valid data detection subroutine.
56	Level zero the master unit.
57	Wait 2 seconds for master to react.
58	Go to frequency step subroutine.
59	Continue program execution at next measurement.
60-72	Frequency step subroutine. Used for Level & Frequency measurement. This subroutine steps the transmitter in frequency, uses the valid data subroutine to enter data, prints the measured data, and returns to main program.
61	Set frequency step subroutine status indicator to one to indicate FREQ STEP in progress.
62	Start of for-next loop to step frequency in 200 Hz steps.
63	Executes SF Skip function.
64	Output the transmit frequency.
65	Wait 2 seconds for master and slave to handshake.

SAMPLE MASTER-SLAVE PROGRAM (32 OF 40)
LINE DESCRIPTION

LINE NO.	EXPLANATION
66	Go to valid data subroutine.
67	Check for an underrange condition. The –9999 shows underrange at master; the 9910 shows underrange at slave. If present, jump to send next frequency. If an underrange did occur, the VALID DATA subroutine printed "UNDERRANGE" already.
68	Check to see if the proper frequency has been transmitted (as measured by the receiving TIMS). Allow a tolerance of plus or minus 10 Hz. If not, then go to print the error condition, and possibly try the measurement again.
69	Print the measured data.
70	End of frequency step loop.
71	Reset status indicator to zero.
72	Return to main program.
73-100	Valid data detection subroutine.
76	This statement reads the measurement data from TIMS for all measurements. If no error is detected, then program execution returns to the originating measurement. If an error is present, it is printed and program execution jumps to the error counter. To determine what kinds of data may be read, see Table 4.
77	Checks for underrange during Level & Frequency, and during FREQ STEP subroutine. If so, then accept this underrange as valid data, print "UNDERRANGE", and return to FREQ STEP.
78	Check for underrange during Message Circuit Noise, Noise-with-Tone, and Signal-to-Noise. If present, then print "UNDERRANGE" and go to the next measurement.
79	Check for underrange during Envelope Delay, and during E.D. DATA subroutine. If so, then accept as valid data and return to E.D. DATA.
80	Check for presence of an error code. Error code present as 99XX number. 9910 is an H-10 error. If present, go to print the code.
81	Check for presence of an underrange condition. If present, go to print the condition.
82	Check for presence of an overrange condition. If present, go to print the condition.
83	If no error present, then return to main program.
84-87	Calculate the error code number, print it, and go to error counter subroutine.
88-90	Print the underrange condition, and go to error counter.

SAMPLE MASTER-SLAVE PROGRAM (33 OF 40)
LINE DESCRIPTION

LINE NO.	EXPLANATION
91-93	Print the overrange condition, and go to error counter subroutine.
94-100	Print the frequency error condition, and go to error counter subroutine.
101-115	Error counter subroutine. The first objective of the counter is to increment the variable "X" by one. If "X" equals 3, then the measurement is not again attempted, but is given up and the next measurement is tried. If "X" is less then 3, then the measurement is again attempted. Lines 109 thru 115 identify the current measurement and direct program execution to the appropriate label.
103	This line aborts the measurement if the initial 1004 Hz link-up has failed three times. The total test is terminated in this case.
104	Resets FREQ STEP and E.D. DATA status indicators to zero. Reset here because VALID DATA may have branched these subroutines to this part of program.
107	Wait 2 seconds before reattempting the measurement.
116-124	Try the next measurement identifier. These lines identify the current measurement and direct program execution to the appropriate label.
125-136	Message Circuit Noise, Master-to-Slave direction.
137-148	Message Circuit Noise, Slave-to-Master direction.
149-160	Noise-with-Tone, Master-to-Slave direction.
161-172	Noise-with-Tone, Slave-to-Master direction.
173-184	Signal-to-Noise, Master-to-Slave direction.
185-196	Signal-to-Noise, Slave-to-Master direction.
197-212	Impulse Noise, Master-to-Slave direction.
213-228	Impulse Noise, Slave-to-Master direction.
229-242	Envelope delay, Master-to-Slave direction.
237	Sets the Envelope Delay measurement and causes an initial carrier frequency of 1804 Hz.
239	Delay zeros the measurement loop at 1804 Hz. This command does not cause all future delay measurements to be referenced to 1804 Hz. However, it does tend to minimize delay values as first measured by TIMS. This helps to prevent measured envelope delay values which would appear in the range of error code numbers.
241	Goes to envelope delay data subroutine to measure delay values, store them, and determine the minimum delay frequency.

SAMPLE MASTER-SLAVE PROGRAM (34 OF 40)
LINE DESCRIPTION

LINE NO.	EXPLANATION
242	Goes to envelope delay print subroutine.
243-256	Envelope Delay, Slave-to-Master direction.
257	Jump program execution to next measurement.
258-281	Envelope delay data gathering subroutine. This routine steps the carrier frequency from 504 Hz to 3204 Hz in 100 Hz steps. SF Skip frequencies are avoided. After each frequency is sent, program execution transfers to the valid data subroutine for entering the measured data.
260	Sets variables J and K to one (row one, column one).
261	Go to valid data subroutine to enter data and check for presence of possible error codes.
262	Set "U" to the value of maximum possible delay of 9999 microseconds. This assures that the minimum delay value will be found by line 272.
264	Set E.D. DATA subroutine status indicator to 1, to indicate the subroutine is in progress.
265	Frequency step for-next loop beginning.
266	SF Skip statement. If present, then jump to row incrementer to increment row number and access next N statement.
267	Output the carrier frequency.
268	Wait 2 seconds for frequency to settle.
269	Go to valid data subroutine.
270	Check for presence of an underrange condition. If present, do not make frequency check or minimum delay check. Go directly to store the underrange numbers.
271	Check for the presence of a frequency translation problem.
272	Check to see if the just measured delay value is less than the current value of "U". If so, then give "U" this new value.
273	Store the measured delay value into row J, column K location.
274	Step to column 2.
275	Store the measured frequency into row J, column K location.
276	Reset to column 1.
278	Increment to next row.

SAMPLE MASTER-SLAVE PROGRAM (35 OF 40)
LINE DESCRIPTION

LINE NO.	EXPLANATION
279	End of for-next loop.
280	Reset E.D. DATA status indicator to zero.
281	Return to main program.
282-303	Envelope Delay print subroutine.
283	Decide if the minimum delay value (U) is a positive or negative number. If positive, then jump over negative number subroutine and access positive number subroutine.
284-292	For-next loop to print delay values where "U" is a negative number.
285	Check for rows where SF Skip has caused empty locations.
286	Set to column one.
287	Assign "A" the values of row J, column 1, plus the absolute value of "U". This assumes "U" is a negative number, and adds the absolute value of "U" to the array location before printing it.
288	Set to column two.
289	Assign "B" the value of row J, column 2.
290	If an underrange code is present as stored data, then print "UNDERRANGE" and go to next array location.
291	Print the measured data.
292	End of for-next loop.
293	Return to main program.
294-302	For-next loop to print delay values where "U" is a positive value. NOTE: Lines 283 thru 302 causes an effective delay zero at the frequency of minimum delay. This frequency may be any of the frequencies specified in the envelope delay data subroutine.
304-315	Phase Jitter, Master-to-Slave direction
316-327	Phase Jitter, Slave-to-Master direction.
328-330	ABORT label and print instruction.
331-336	End of Test.

SAMPLE MASTER-SLAVE PROGRAM (36 OF 40)
SAMPLE PRINTOUT

```
LEVEL & FREQUENCY TEST, MASTER-TO-SLAVE DIRECTION

          23.6     DB     AT       204 HZ
           8.0     DB     AT       404 HZ
           4.2     DB     AT       604 HZ
           1.2     DB     AT       804 HZ
           0.0     DB     AT      1004 HZ
          -0.3     DB     AT      1204 HZ
          -0.2     DB     AT      1404 HZ
           0.1     DB     AT      1605 HZ
           0.7     DB     AT      1804 HZ
           1.5     DB     AT      2004 HZ
           2.9     DB     AT      2204 HZ
           5.2     DB     AT      2404 HZ
          10.4     DB     AT      2804 HZ
          12.6     DB     AT      3004 HZ
          23.1     DB     AT      3204 HZ
          29.3     DB     AT      3404 HZ
          34.7     DB     AT      3604 HZ
    UNDERRANGE


LEVEL & FREQUENCY TEST, SLAVE-TO-MASTER DIRECTION

          23.6     DB     AT       204 HZ
           7.9     DB     AT       404 HZ
           4.1     DB     AT       604 HZ
           1.2     DB     AT       804 HZ
           0.0     DB     AT      1004 HZ
          -0.3     DB     AT      1204 HZ
          -0.3     DB     AT      1404 HZ
           0.1     DB     AT      1604 HZ
           0.6     DB     AT      1804 HZ
           1.5     DB     AT      2004 HZ
           2.9     DB     AT      2204 HZ
           5.3     DB     AT      2404 HZ
          10.4     DB     AT      2804 HZ
          12.6     DB     AT      3005 HZ
          23.1     DB     AT      3204 HZ
          29.3     DB     AT      3404 HZ
          34.8     DB     AT      3604 HZ
          40.1     DB     AT      3804 HZ
```

SAMPLE MASTER-SLAVE PROGRAM (37 OF 40)
SAMPLE PRINTOUT

```
MESSAGE CKT NOISE TEST, MASTER-TO-SLAVE DIRECTION
            41 DBRN --- C-MSG FILT

MESSAGE CKT NOISE TEST, SLAVE-TO-MASTER DIRECTION
    UNDERRANGE

NOISE-WITH-TONE TEST, MASTER-TO-SLAVE DIRECTION
            41 DBRN --- C-MSG FILT

NOISE-WITH-TONE TEST, SLAVE-TO-MASTER DIRECTION
            21 DBRN --- C-MSG FILT

SIGNAL-TO-NOISE TEST, MASTER-TO-SLAVE DIRECTION
            19    DB   AT     1004 HZ --- C-MSG FILT

SIGNAL-TO-NOISE TEST, SLAVE-TO-MASTER DIRECTION
            59    DB   AT     1005 HZ --- C-MSG FILT

IMPULSE NOISE TEST, MASTER-TO-SLAVE DIRECTION
           959 COUNTS IN 5 MINUTES --- C-MSG FILT

IMPULSE NOISE TEST, SLAVE-TO-MASTER DIRECTION
           122 COUNTS IN 5 MINUTES --- C-MSG FILT
```

SAMPLE MASTER-SLAVE PROGRAM (38 OF 40)
SAMPLE PRINTOUT

```
ENVELOPE DELAY TEST, MASTER-TO-SLAVE DIRECTION

 3082    MICRO   SEC   AT     504 HZ
 2472    MICRO   SEC   AT     604 HZ
 2059    MICRO   SEC   AT     704 HZ
 1634    MICRO   SEC   AT     804 HZ
 1243    MICRO   SEC   AT     904 HZ
  905    MICRO   SEC   AT    1004 HZ
  631    MICRO   SEC   AT    1104 HZ
  424    MICRO   SEC   AT    1204 HZ
  272    MICRO   SEC   AT    1304 HZ
  161    MICRO   SEC   AT    1404 HZ
   82    MICRO   SEC   AT    1504 HZ
   30    MICRO   SEC   AT    1604 HZ
    2    MICRO   SEC   AT    1704 HZ
    0    MICRO   SEC   AT    1304 HZ
   24    MICRO   SEC   AT    1904 HZ
   79    MICRO   SEC   AT    2004 HZ
  175    MICRO   SEC   AT    2104 HZ
  329    MICRO   SEC   AT    2204 HZ
  555    MICRO   SEC   AT    2304 HZ
  877    MICRO   SEC   AT    2404 HZ
 2441    MICRO   SEC   AT    2804 HZ
 2862    MICRO   SEC   AT    2904 HZ
 3254    MICRO   SEC   AT    3004 HZ
 1821    MICRO   SEC   AT    3104 HZ
  318    MICRO   SEC   AT    3204 HZ
```

SAMPLE MASTER-SLAVE PROGRAM (39 OF 40)
SAMPLE PRINTOUT

```
ENVELOPE DELAY TEST, SLAVE-TO-MASTER DIRECTION

 3190    MICRO   SEC   AT      504 HZ
 2487    MICRO   SEC   AT      604 HZ
 2057    MICRO   SEC   AT      704 HZ
 1634    MICRO   SEC   AT      804 HZ
 1247    MICRO   SEC   AT      904 HZ
  906    MICRO   SEC   AT     1004 HZ
  641    MICRO   SEC   AT     1104 HZ
  442    MICRO   SEC   AT     1204 HZ
  288    MICRO   SEC   AT     1304 HZ
  172    MICRO   SEC   AT     1405 HZ
   91    MICRO   SEC   AT     1504 HZ
   39    MICRO   SEC   AT     1604 HZ
   17    MICRO   SEC   AT     1704 HZ
    0    MICRO   SEC   AT     1804 HZ
   21    MICRO   SEC   AT     1904 HZ
   80    MICRO   SEC   AT     2004 HZ
  186    MICRO   SEC   AT     2104 HZ
  345    MICRO   SEC   AT     2204 HZ
  574    MICRO   SEC   AT     2304 HZ
  879    MICRO   SEC   AT     2404 HZ
 2567    MICRO   SEC   AT     2804 HZ
 2888    MICRO   SEC   AT     2904 HZ
 3297    MICRO   SEC   AT     3004 HZ
 1789    MICRO   SEC   AT     3104 HZ
  343    MICRO   SEC   AT     3205 HZ
```

SAMPLE MASTER-SLAVE PROGRAM (40 OF 40)
SAMPLE PRINTOUT

```
PHASE JITTER TEST, MASTER-TO-SLAVE DIRECTION
          0.1    DEGREES P-P

PHASE JITTER TEST, SLAVE-TO-MASTER  DIRECTION
          2.7    DEGREES P-P

END OF TEST
```

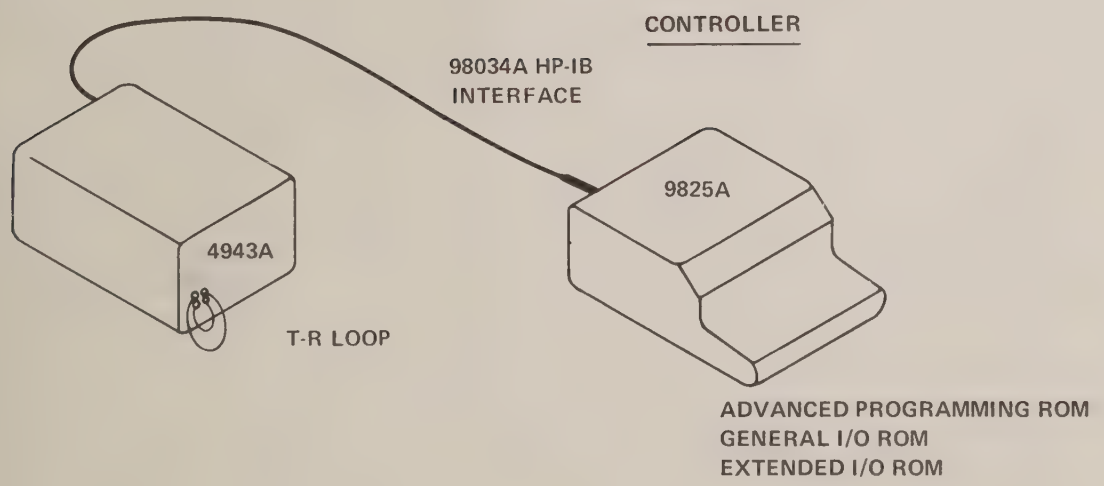
OPTIONAL VERIFICATION PROGRAM (1 OF 19)

PURPOSE: To verify proper operation of the HP-IB interface in the 4943A. This program may be reviewed as an operational example, or simply used as an operational check. The 4943A user may wish to pick and choose program segments according to need, or possibly store the continuous program on a tape cartridge.

INDEX:

TEST NAME	LINE NO.
Remote Test	0-38
Self Check Test	39-67
Clear Test	68-95
Local Test	96-125
Abort Test	126-156
Serial Poll Test	157-194
Master-Slave Test	195-291

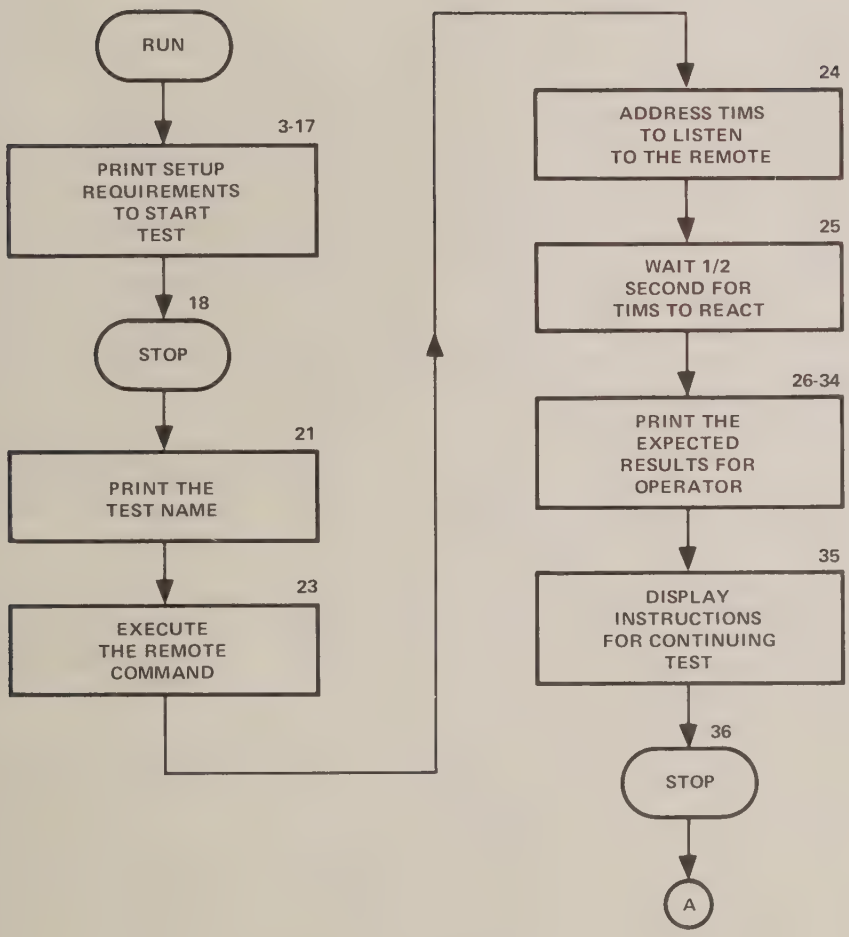
TEST SETUP, NORMAL MODE:



OPTIONAL VERIFICATION PROGRAM (2 OF 19)
SETUP AND REMOTE TEST

```
0: "BEGIN OPTIONAL VERIFICATION PROGRAM---MODEL 4943A":
1: "25 AUG 77 --- FILE 5":
2:
3: prt "SETUP:"
4: spc
5: prt "1. Loop T-M."
6: spc
7: prt "2. LEV. x FREQ."
8: spc
9: prt "3. REMOTE to"
10: prt "    NORMAL."
11: spc
12: prt "4. Adjust Level"
13: prt "    to 0.0 DBM "
14: spc
15: prt "5. Press"
16: prt "    CONTINUE"
17: spc 2
18: stp
19:
20:
21: prt 'REMOTE TEST'
22: spc
23: rem 7
24: wrt 710
25: wait 500
26: prt "The 4943's sho
27: prt "now display the
28: prt "HP-IB"
29: prt "annunciator."
30: spc
31: prt "If so, then"
32: prt "Remote is"
33: prt "working."
34: spc 2
35: dsp "PRESS CONTINUE FOR SELF CK TEST'
36: stp
37:
38:
```

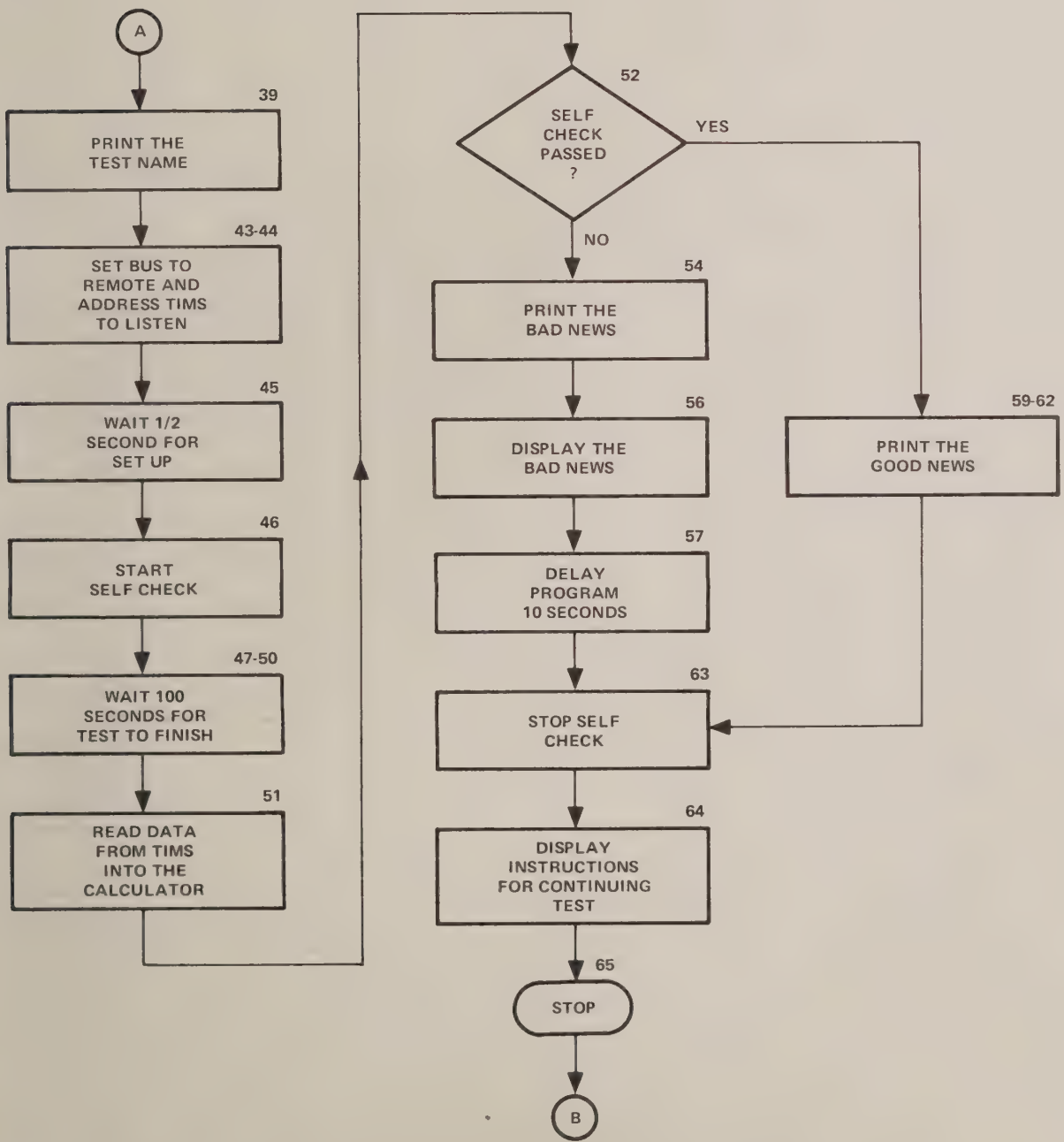
OPTIONAL VERIFICATION PROGRAM (3 OF 19)
SETUP AND REMOTE TEST



OPTIONAL VERIFICATION PROGRAM (4 OF 19)
SELF CHECK TEST

```
39: prt "SELF CK TEST"
40: spc 2
41: fmt 0
42: 0→A
43: rem 7
44: wrt 710
45: wait 500
46: wrt 710,"C1E"
47: wait 30000
48: wait 30000
49: wait 30000
50: wait 10000
51: red 710,A
52: if A=9955;gto "PASSED
53: spc
54: prt "SELF CHK FAILED"
55: spc 2
56: dsp "H-CODE APPEARS ON 4.9 A [S"
57: wait 10000
58: gto +5
59: "PASSED":
60: spc
61: prt "PASSED SELF CHK
62: spc 2
63: wrt 710,"C0E"
64: dsp "PRESS CONTINUE FOR [ERROR" [S
65: stp
66:
67:
```

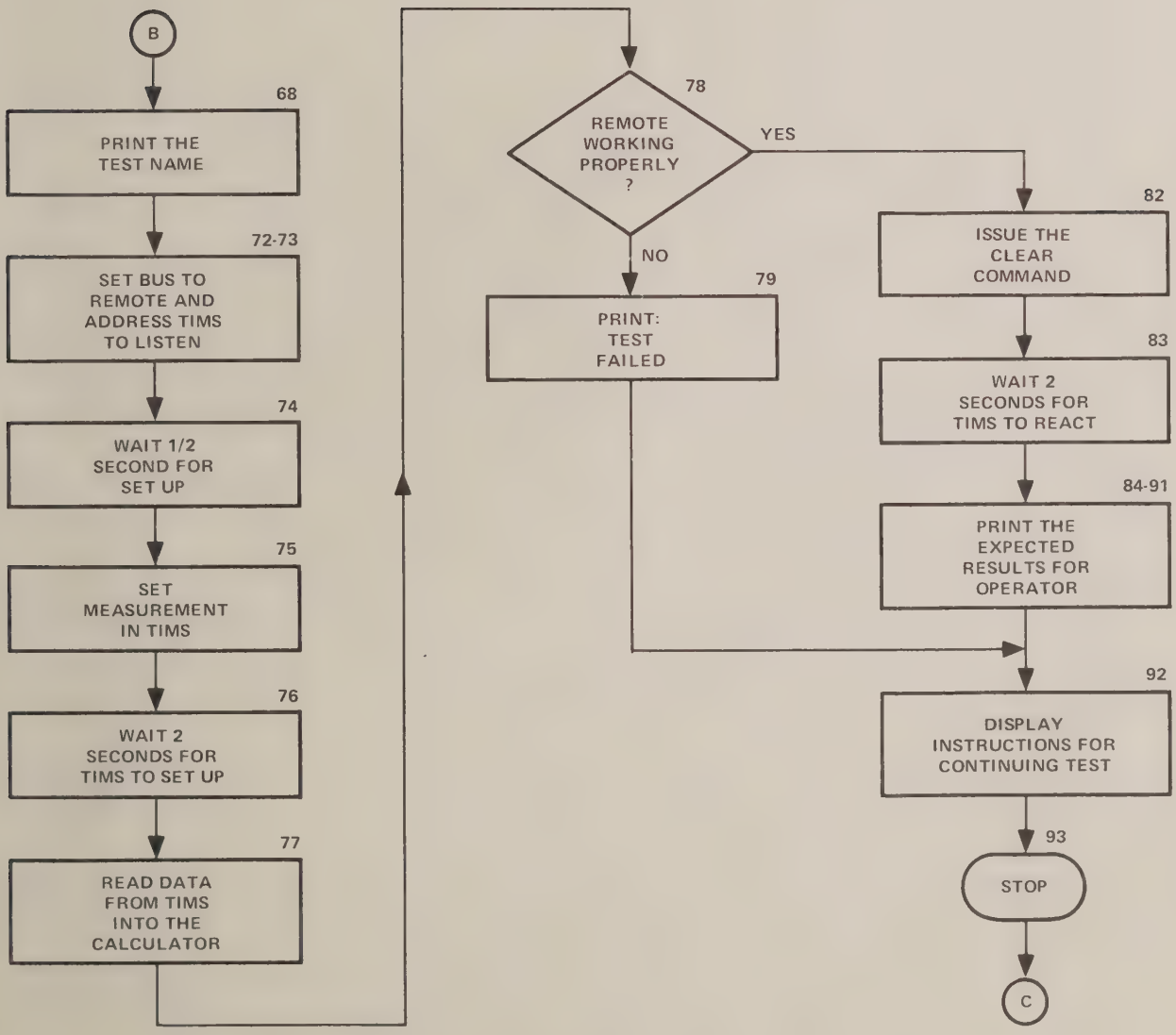
OPTIONAL VERIFICATION PROGRAM (5 OF 19)
SELF CHECK TEST



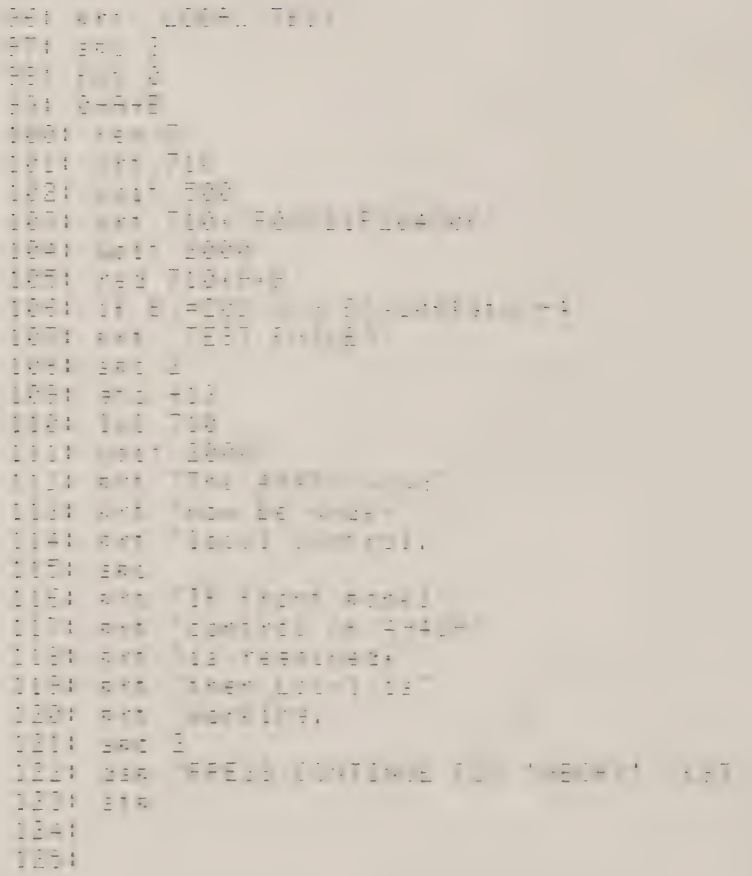
OPTIONAL VERIFICATION PROGRAM (6 OF 19)
CLEAR TEST

```
68: prt "CLEAR TEST"
69: spc 2
70: fmt 0
71: 0→A→B
72: rem 7
73: wrt 710
74: wait 500
75: wrt 710,"F0M1U1F20<00E"
76: wait 2000
77: red 710,A,B
78: if B>=202 and A<>0;msg -4
79: prt "TEST FAILED"
80: spc 2
81: gto +11
82: clr 7
83: wait 2000
84: prt "The 4943A should"
85: prt "now display:"
86: prt "1004 RCV HZ."
87: spc
88: prt "If so, then"
89: prt "Clear is"
90: prt "working."
91: spc 2
92: dsp "PRESS CONTINUE FOR 'CLEAR' TEST
93: stp
94:
95:
```

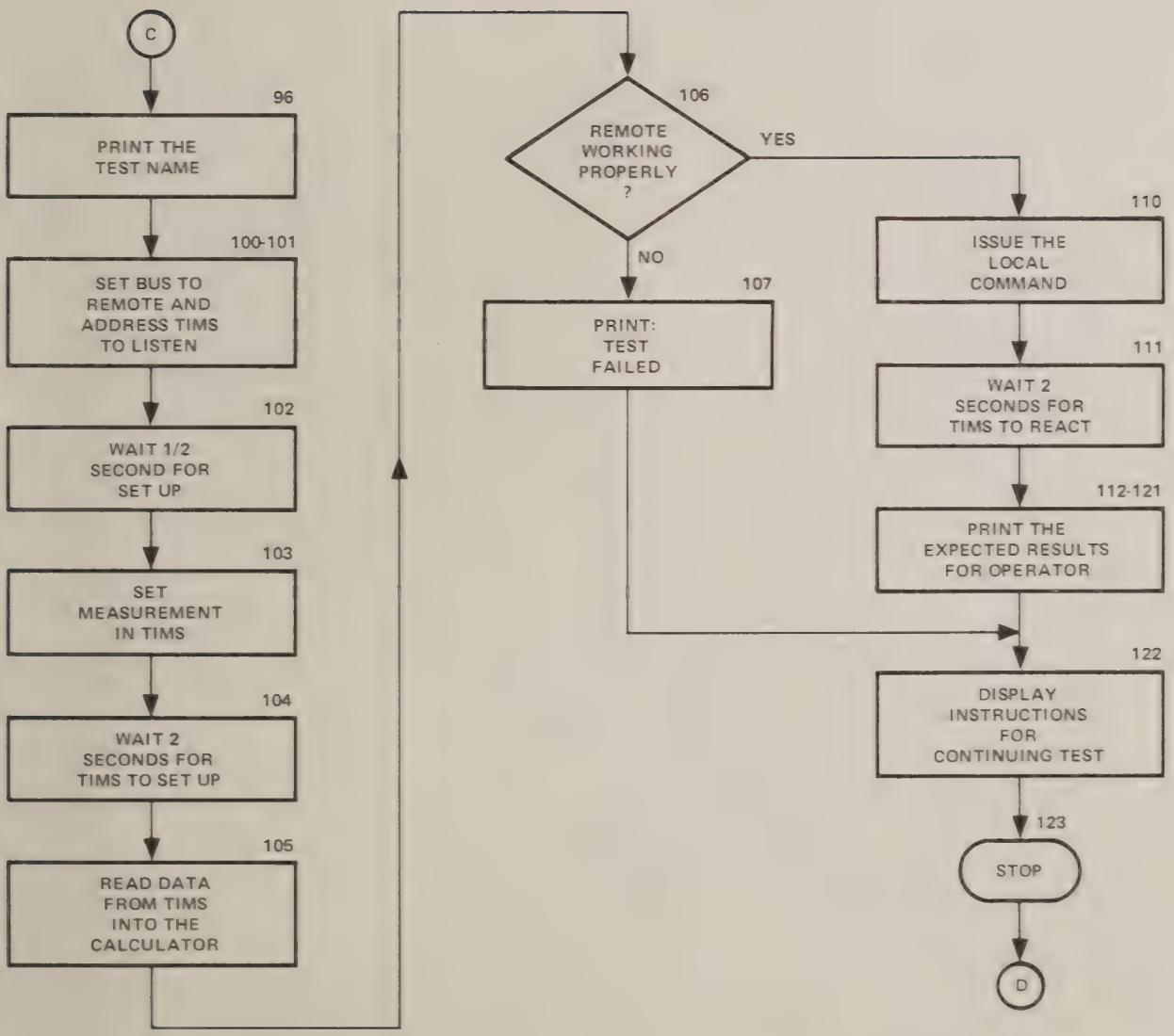
OPTIONAL VERIFICATION PROGRAM (7 OF 19)
CLEAR TEST



OPTIONAL VERIFICATION PROGRAM (8 OF 19)
LOCAL TEST



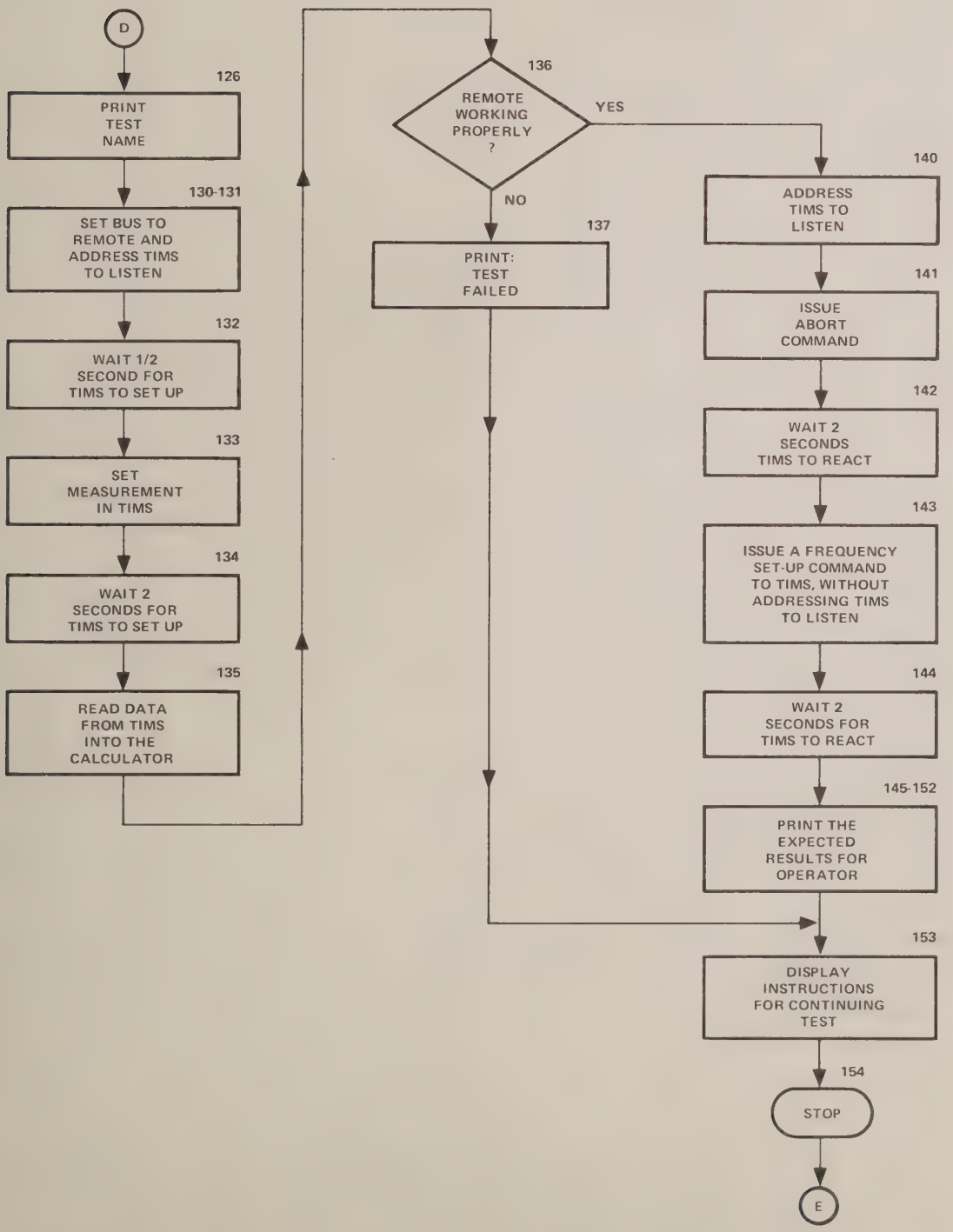
OPTIONAL VERIFICATION PROGRAM (9 OF 19)
LOCAL TEST



OPTIONAL VERIFICATION PROGRAM (10 OF 19)
ABORT TEST

```
126: prt "ABORT TEST"
127: spc 2
128: fmt 0
129: 0→A→B
130: rem 7
131: wrt 710
132: wait 500
133: wrt 710,"R0M1D1F20400E"
134: wait 2000
135: red 710,A,B
136: if B>=202 and B<=206;sto +4
137: prt "TEST FAILED"
138: spc 2
139: sto +14
140: wrt 710
141: cli 7
142: wait 2000
143: cmd 7,"U","F3@04E"
144: wait 2000
145: prt "The 4943A should"
146: prt "still display"
147: prt "204 Hz."
148: spc
149: prt "If so, then"
150: prt "Abort is"
151: prt "working."
152: spc 2
153: dsp "CONTINUE FOR SERIAL POLL TEST"
154: stp
155:
156:
```

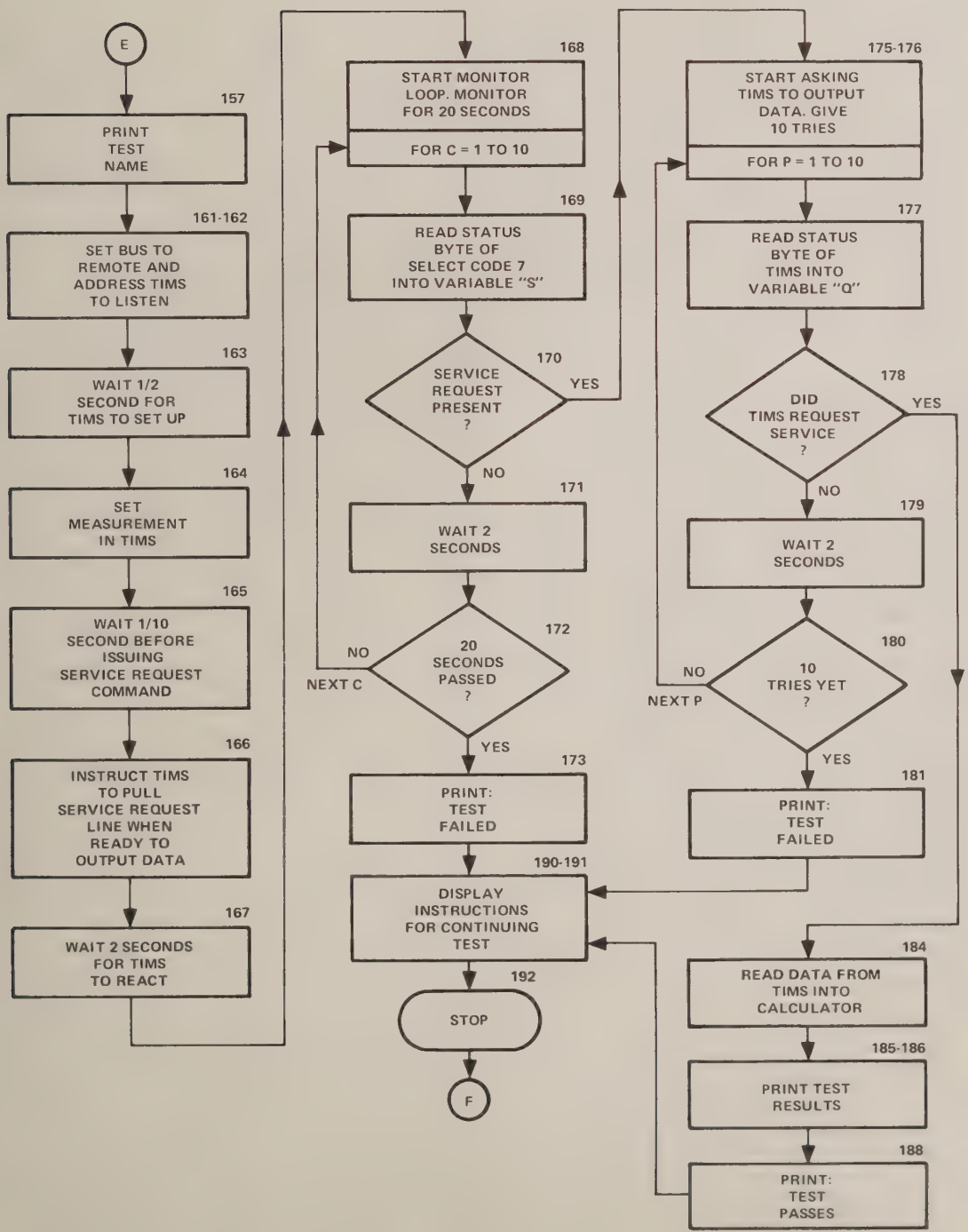
OPTIONAL VERIFICATION PROGRAM (11 OF 19)
ABORT TEST



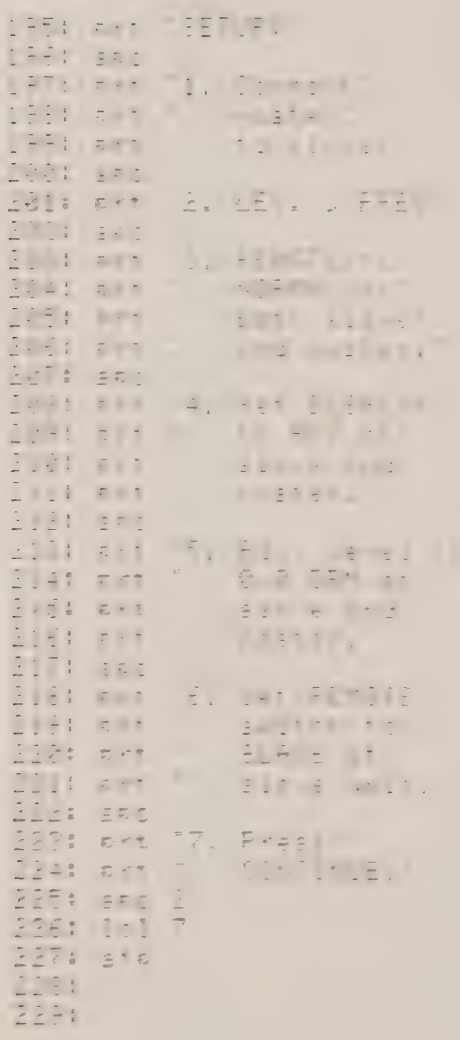
OPTIONAL VERIFICATION PROGRAM (12 OF 19)
SERIAL POLL TEST

```
157: prt "SERIAL POLL TEST"
158: spc 2
159: 0→A→B→C→P→Q
160: fmt 0
161: rem→7
162: wrt 710
163: wait 500
164: wrt 710;"R0M1D1E"
165: wait 100
166: wrt 710;"O1E"
167: wait 2000
168: for C=1 to 10
169: rds(7)→S
170: if bit(7,S)=1;gto "SER POL"
171: wait 2000
172: next C
173: prt "SERV REQ FAILED"
174: gto "FAIL"
175: "SER POL":
176: for P=1 to 10
177: rds(710)→Q
178: if Q=80;gto +6
179: wait 2000
180: next P
181: prt "SER POLL FAILED"
182: spc
183: gto "FAIL"
184: red 710,A,B
185: fxd 1;prt "DBM",A
186: fxd 0;prt "AT FREQ",B
187: spc
188: prt "TEST PASSES"
189: spc 2
190: "FAIL":
191: dsp "CONTINUE FOR MASTER-SLAVE TEST"
192: stp
193:
194:
```

OPTIONAL VERIFICATION PROGRAM (13 OF 19)
SERIAL POLL TEST

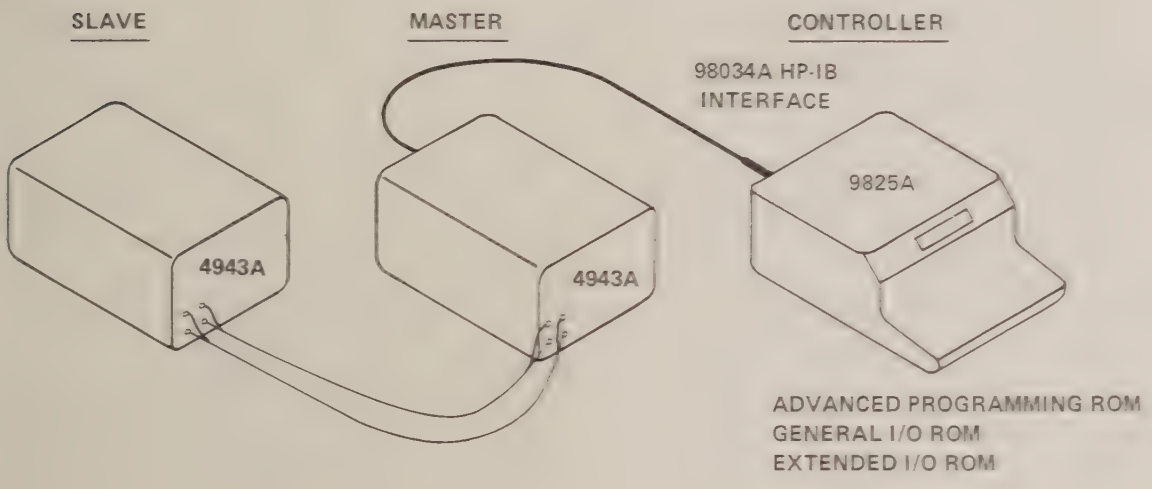


OPTIONAL VERIFICATION PROGRAM (14 OF 19)
MASTER-SLAVE TEST



OPTIONAL VERIFICATION PROGRAM (15 OF 19)
MASTER-SLAVE TEST

TEST SETUP, MASTER-SLAVE MODE:

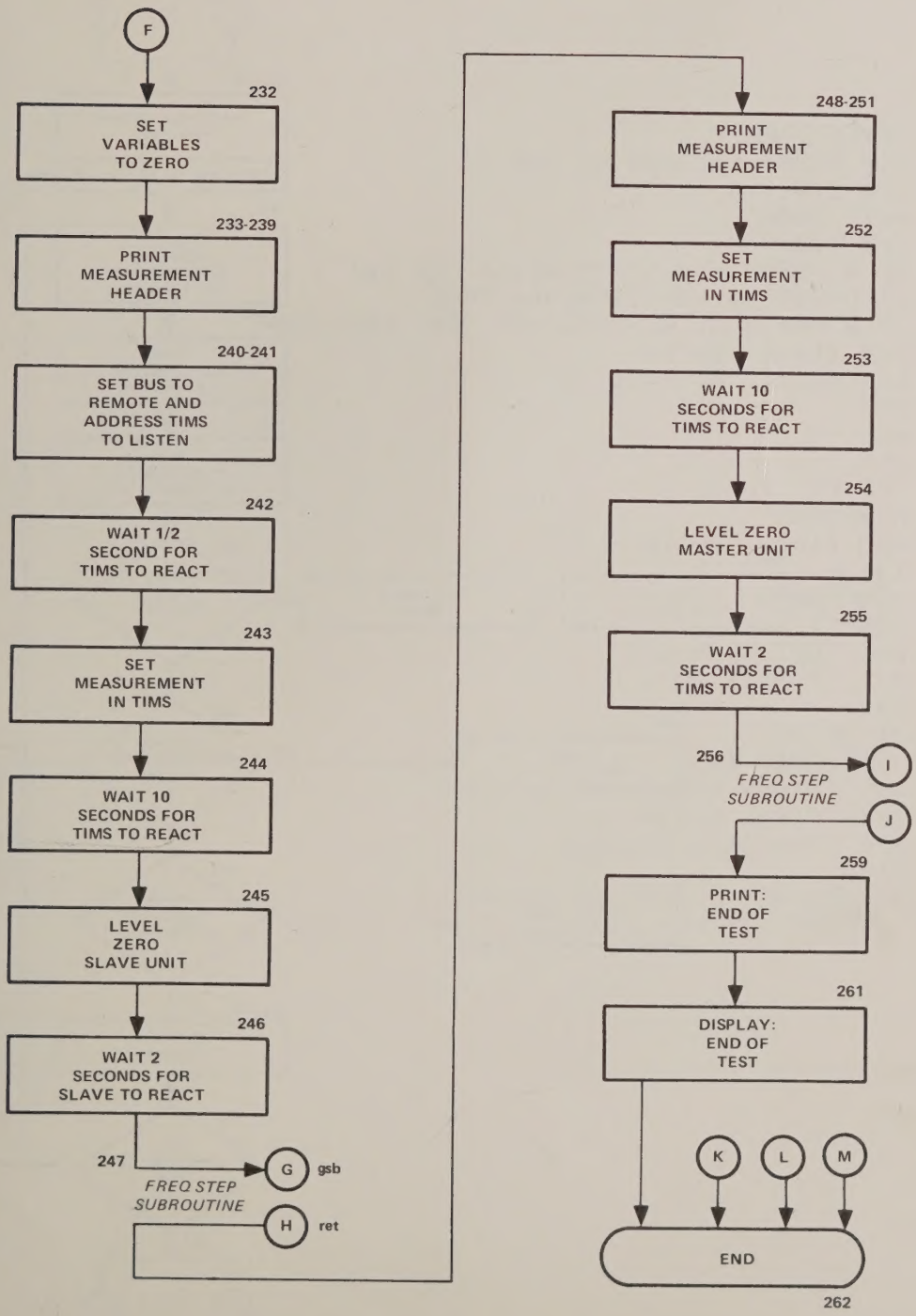


ADVANCED PROGRAMMING ROM
GENERAL I/O ROM
EXTENDED I/O ROM

OPTIONAL VERIFICATION PROGRAM (16 OF 19)
MASTER-SLAVE TEST

```
230: fmt 0
231: fmt 1,"F",f10.0,"E"
232: 0→A→B→N
233: spc
234: prt "LEVEL AND"
235: prt "FREQUENCY TEST"
236: spc
237: prt "MASTER-TO-SLAVE"
238: prt "DIRECTION"
239: spc
240: rem 7
241: wrt 710
242: wait 500
243: wrt 710,"R1M1D1F1,0400E"
244: wait 10000
245: wrt 710,"Z0E"
246: wait 2000
247: gsb "FREQ STEP"
248: spc
249: prt "SLAVE-TO-MASTER"
250: prt "DIRECTION"
251: spc
252: wrt 710,"R2F1004E"
253: wait 10000
254: wrt 710,"Z0E"
255: wait 2000
256: gsb "FREQ STEP"
257: "END":
258: spc
259: prt "END OF TEST"
260: spc 2
261: dsp "END OF TEST"
262: end
```

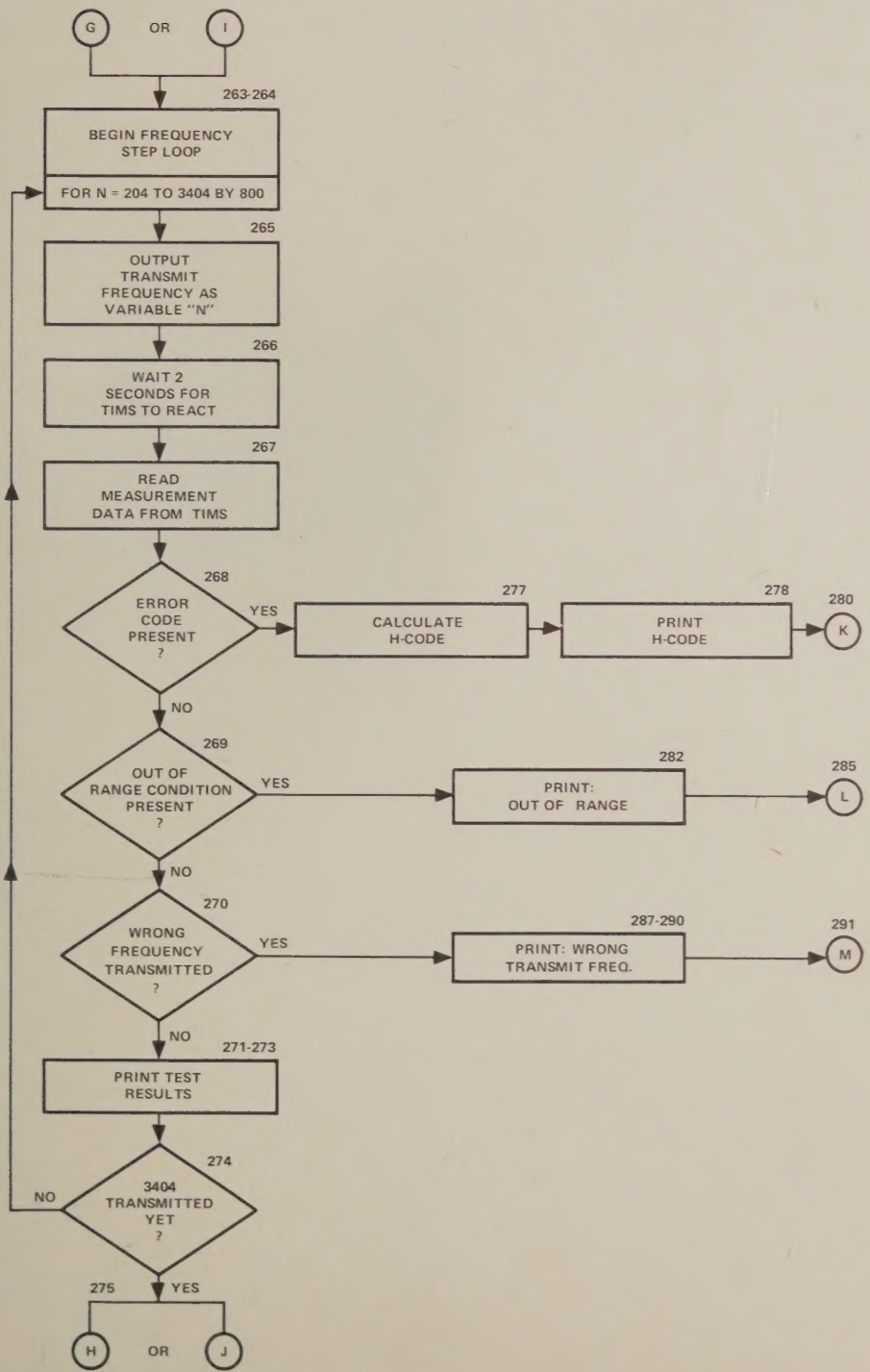
OPTIONAL VERIFICATION PROGRAM (17 OF 19)
MASTER-SLAVE TEST



OPTIONAL VERIFICATION PROGRAM (18 OF 19)
MASTER-SLAVE TEST

```
263: "FREQ STEP":
264: for N=204 to 3404 by 800
265: wrt 710.1,N
266: wait 2000
267: red 710,A,B
268: if A>=9900 and A<=9916;gto "ER PRT"
269: if A=9999 or A=-9999;gto "OOR"
270: if B>=N+10 or B<=N-10;gto "PRT FREQ ER"
271: fxd 1;prt "DB",A
272: fxd 0;prt "AT FREQ",B
273: spc
274: next N
275: ret
276: "ER PRT":
277: A-9900→A
278: fxd 0;prt "H-",A
279: spc
280: gto "END"
281: "OOR":
282: prt "OUT OF RANGE"
283: prt "CONDITION"
284: spc
285: gto "END"
286: "PRT FREQ ER":
287: prt "Wrong transmit"
288: prt "freq. present."
289: prt "Possible dropout"
290: spc
291: gto "END"
```

OPTIONAL VERIFICATION PROGRAM (19 OF 19)
MASTER-SLAVE TEST



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